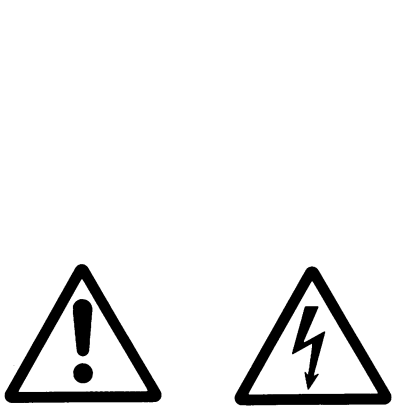
MP1 SCR DeviceNet Head

INSTALLATION, OPERATION and MAINTENANCE MANUAL
Revision 7

DeviceNet™ Vendor ID # 977



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ABOUT ODVA™

ODVA is an international association comprised of members from the world's leading automation companies. Collectively, ODVA and its members support network technologies based on the Common Industrial Protocol (CIP™). These currently include the network adaptations of CIP—EtherNet/IP™, DeviceNet™ and CompoNet™—and major application extensions to CIP—CIP Safety™, CIP Motion™ and CIP Sync™. ODVA manages the development of these open technologies, and assists manufacturers and users of CIP Networks through tools, training and promotional activities.

In addition, ODVA offers conformance testing to help ensure that products built to its specifications operate in multi-vendor systems. ODVA also is active in other standards development organizations and industry consortia to drive the growth of open communication standards. For more information, visit its web site at www.odva.org.

REVISION PAGE

Date	Revision	Sec	Change
6/25/07	1	214	Change Product Revision to 2.001 (firmware)
		169	ADC Setpt Span: change max to 10237 (rev2.001)
		170	ADC Feedbck Span: change max to 10237 (rev2.001)
		163	Vin CAL ZERO: change max to 200 (rev2.001)
		164	Vout CAL ZERO: change max to 200 (rev2.001)
		165	In CAL ZERO: change max to 200 (rev2.001)
		166	Iout CAL ZERO: change max to 200 (rev2.001)
		167	KWout CAL ZERO: change max to 200 (rev2.001)
		168	Conduct CAL ZERO: change max to 200 (rev2.001)
		95	Invert Discretes: correct description
		78	Table 14: correct descriptions
		111	Firmware Rev: update default value to 2001 (rev2.001)
		217	Note Major Rev update in Identity Object (rev2.001)
08/07/07	2	215	UCMM Explicit Message Groups, change to group 3 only
		215	Dynamic I/O Message Groups, change to group 1 only
09/24/09	3	Index	Update Index Page References
11/2012	4	All	Formatting
		TOC	Page References
		11	Daylight savings time
		Index	Update Index Page References
			EC Declaration of Conformity
07/2015	5	Cover	Company Address
10/30/18	6	3.3.4	Changed terminal nos. from 31-36 to 51-56
		3.3.5	Changed terminal nos. from 31-36 to 51-56
		3.3.6	Changed terminal nos. from 31-36 to 51-56
		Appx D	Changed terminal nos. from 31-36 to 51-56, ECO #18-H010
			Added header and Footer info
7/15/24	7	1.6	Added warning section

NOTE: SPECIFICATIONS SUBJECT TO CHANGE WITHOUT PRIOR NOTICE.

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1 MANUAL INTRODUCTION

1.1 Manual Objectives

The purpose of this manual is to provide you with the information to apply the MP1 CONTROLLER with DeviceNet communications. Described in this manual are methods for installing, configuring, and troubleshooting.

IMPORTANT Read this manual in its entirety before installing, operating, servicing, or initializing the MP1 CONTROLLER.

1.2 Who Should Use This Manual

This manual is intended for qualified personnel responsible for setting up and servicing the MP1 Controller. You must have previous experience with and a basic understanding of SCR power controllers communications technology, configuration procedures, required equipment and safety precautions.

In the most minimal application, the MP1 CONTROLLER may be operated with all parameters preconfigured and without any digital communication. To make efficient use of all features of the MP1 CONTROLLER, you must be able to program and operate serial communication devices as well as have a basic understanding of its parameter settings and functions.

You should understand DeviceNet network operations, including how slave devices operate on the network and communicate with a DeviceNet master.

1.3 Vocabulary

In this manual, we refer to the: "**MP1 Controller"** as it applies to the combination of the **MP1 SCR DeviceNet Head** option combined with the additional components needed to form a complete SCR controller. When needed for clarification, the **MP1 SCR DeviceNet Head** will be referenced specifically.

1.4 Conventions

DeviceNet parameter names within text are shown in *italic* typeface, or in 'single quotes' in tables.
Modbus™ parameter names are shown in angles <name>.

1.5 Reference

To install and implement a DeviceNet network, please refer to the publication "ODVA™ Planning and Installation Manual DeviceNet™ Cable System", Pub. PUB00027R1, available from www.ODVA.org .

1.6 Warnings

Observe all warnings and cautions in this manual. Failure to do so may result in serious injury or death.

Refer all service to properly trained and qualified service personnel. Never work alone.

WARNING - HAZARDOUS VOLTAGES EXIST AT THE POWER CONTROLLER HEAT SINKS AND AT THE LOAD AT ALL TIMES WHEN THE INPUT VOLTAGE IS CONNECTED. THIS CONDITION EXISTS EVEN WHEN THE CONTROLLER IS SET TO DELIVER ZERO OUTPUT

This manual contains important safety instructions that must be followed during the installation and maintenance of the SCR Power controller. Read this manual thoroughly before attempting to operate this Power controller.

WARNING - BRANCH CIRCUIT OVERCURRENT PROTECTION IS REQUIRED TO BE PROVIDED IN ACCORDANCE WITH THE NATIONAL AND/OR LOCAL CODE OF THE INSPECTING AUTHORITY

CAUTION

Printed circuit boards contain sensitive components that can be damaged by electrostatic discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

In case of fire, use a dry chemical fire extinguisher to put out the fire. Using a liquid fire extinguisher may cause electric shock.

The SCR Power Controller makes use of components dangerous for the environment (electronic printed circuit boards, electronic components). The components removed must be taken to specialized collection and disposal centers.

CAUTION - THE APPLICATION OF FAN POWER SHOULD PRECEDE OR COINCIDE WITH THE TURNON OF THE LINE VOLTAGE SOURCE THAT IS TO BE CONTROLLED BY THE DISCONNECT.

2 PRODUCT OVERVIEW

2.1 Introduction

This section provides a brief overview of the features and functionality of the MP1 Controller. Details of digital communication parameters will only be referenced briefly in the overview section when needed for explanation.

2.2 Models Covered

MP1 Controller refers to any model that has been upgraded to include the MP1 SCR DeviceNet Head as an option. New controllers including the MP1 SCR DeviceNet Head option are assumed in descriptions. The MP1 SCR DeviceNet Head may also be retrofitted onto suitable HDR SCR controllers. Consult the factory for available ordering/service options.

2.3 General Description

The MP1 Controller is a solid-state, single-phase, SCR power controller capable of multiple SCR firing modes. In Phase Fire Mode, it supports multiple regulation modes: Voltage, Current, Power, Resistance, External Feedback, and Open Loop. The DSP-based controller handles all communication, control, configuration, calibration, and measurement. Digital control provides predictable and repeatable control and measurement. The Input/Output communication can combine standard process control signals and digital communication. Local serial ports make it possible to provide a powerful, yet inexpensive, mini-HMI control panel. Such a control panel is not required to use the controller.

The unit is relatively simple to operate once configured for a given purpose. While a substantial amount of metering and status information is available, the user may use as much or as little as needed.

A complete controller requires the MP1 SCR DeviceNet Head and an SCR assembly consisting of two SCRs connected back-to-back with a semiconductor fuse, RC snubber, at least one current transformer, and MOV protection. The integrated heatsink and cooling system will be sized for the given SCR. Fuse switch, thermostat, and connectors complete the package.

Multiple SCR Firing Modes - The controller may be configured to operate as a (PF) Phase Fired controller, a variable duty cycle (ZF) Zero Fired controller, or a fixed duty cycle (ZFT) Zero Fire into a Transformer controller.

One special firing mode, PFZF, combines the PF and ZF modes for quick switchover between the two. With PFZF firing, multiple methods are available to switch the controller between Zero Fire mode and Phase Fire mode.

Stand-alone Discrete and Analog Control – The controller can be configured to run without any digital communication. Similar to a traditional analog controller, it can operate using only discrete contact input controls with an analog command input that may be used with 0-20 mA, 4-20 mA, 0-10 V dc, or manual potentiometer command.

Three 0-20/4-20 mA transmitters along with one Form C Relay provides discrete/analog output information. The information provided by these is programmable.

Front panel LEDs provide status and alarm information.

All DeviceNet Control – The MP1 Controller may be monitored via DeviceNet, or operated fully from the network. The local discrete/analog I/O supplement network control.

All Local Digital Control – The MP1 Controller also includes two local serial ports (RS-232 + RS-485) allowing local configuration, calibration, monitoring, or control. A mini-HMI panel from HDR may be used as a local control panel. A local HMI is considered a local control panel and has higher control priority than DeviceNet if manual start/stop or manual setpoint is used.

The MP1 Controller is designed for very flexible custom controls. It may be operated with all analog/discrete controls, all digital controls, or a mix.

2.4 Applications and Available SCR Firing Modes

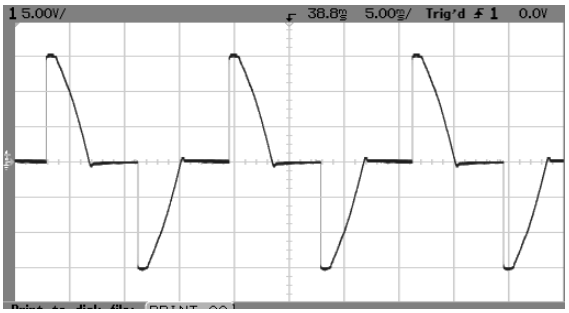
The MP1 Controller is designed to provide a custom solution to users who need to provide precise control of electrical power. The priority of these needs may center on digital communication capability, SCR control capability, or a blend of both.

Network Control Applications - The DeviceNet interface allows full network monitoring and control. As a CIP™ based protocol, DeviceNet communication can be passed efficiently to other CIP based networks such as ControlNet™ and Ethernet/IP™.

PF - Phase Fired Mode provides extremely fine variable firing angle control for precise control of single-phase power to resistive or inductive loads. This is preferred for transformer coupled loads or loads with large resistance fluctuations (where current limiting may be required). The most demanding heating applications require the most precise, predictable, and repeatable control, both for quality control and energy efficiency. The SCR control, metering, and monitoring are optimized for phase fired applications.

Phase firing varies the turn-on time of each SCR on each half-cycle of the sine wave. This provides the ability to continuously adjust the resulting output voltage during each cycle.

Figure 1 PF - Phase Firing Waveform at 50% Duty Cycle



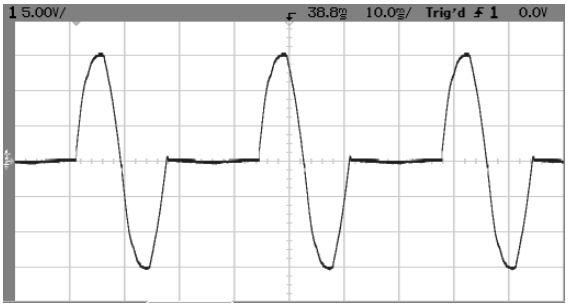
ZF - Zero Fired Mode may be used with suitable loads to minimize harmonics and maximize power factor. With Zero Firing, the SCRs are either turned on, or held off, for the duration of each full sine wave. The output voltage during each cycle is either full line voltage or zero. The ratio of on cycles and off cycles are varied over time to reach an average power level.

Zero firing does not use a fixed time base and the number of cycles used for one on/off sequence will be the smallest number of cycles needed to provide the desired percentage of on time. The minimum on time is one cycle.

For example,
10% on time requires 1 cycle on + 9 cycles off; (10 cycles),
50% on time requires 1 cycle on and 1 cycle off (2 cycles), and
90% on time requires 9 cycles on and 1 cycle off (10 cycles).

Zero firing with a variable time base minimizes the thermal cycling of the load elements.

Figure 2 ZF - Zero Fire with Variable Time Base Waveform at 50%

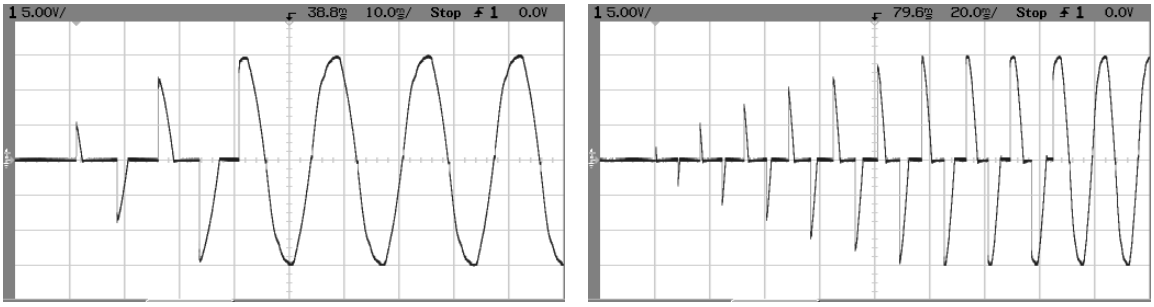


ZFT - Zero Fire into a Transformer Mode may be used with suitable loads when transformer coupling is also required. ZFT mode is similar to ZF mode with modification to accommodate the requirement of zero firing into a transformer. A fixed 100 cycle time base is used.

For example,
10% on time requires 10 cycle on + 90 cycles off; (100 cycles),
50% on time requires 50 cycle on and 50 cycle off (100 cycles), and
90% on time requires 90 cycles on and 10 cycle off (100 cycles).

The first time the SCRs turn on, they must operate in phase fire mode for a few cycles to avoid destructive overloads and guarantee the level of transformer magnetization for future cycles. This walk-up time may be set from 3 to 10 cycles (10 is the default).

Figure 3 ZFT First Turn-on with Phase Walkup of 3 Cycles and 10 Cycles



Each consecutive turn on of the SCRs for a given 100 cycle period must be 2 to 100 cycles on with a reduced conduction time for the first half-cycle. The first half-cycle conduction time is configurable from 10-90%. The default setting is 50% of a half-cycle or about one-quarter cycle. This may be adjusted for a given transformer by monitoring the current waveform while the setting is adjust slightly up or down from 50%

Figure 4 ZFT Subsequent Turn-on with Reduced First Half-cycle Set at 50%

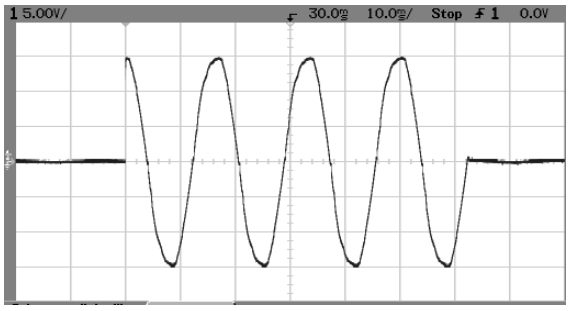
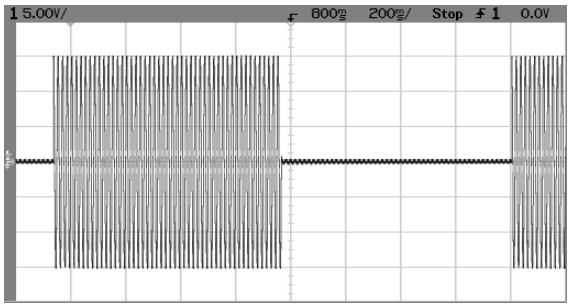


Figure 5 100 Cycles of ZFT Waveform at Approximately 50% Duty Cycle



PFZF – PhaseFire/ZeroFire Mode provides a unique ability to easily switch between two modes using the same controller using several control methods (and without changing the firing mode configuration). PFZF is used with **non-transformer coupled loads** that have very low resistance when cold, requiring phase control current limiting, and normal resistance when hot, suitable for zero fire control.

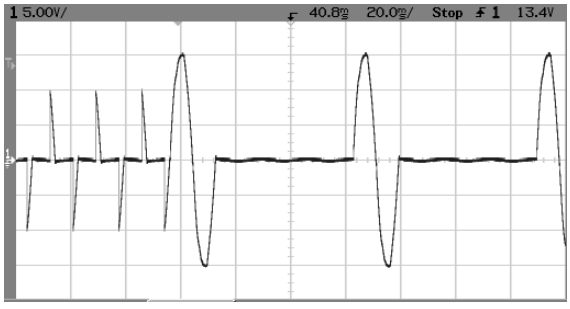
PFZF allows switching between PF and ZF mode using any of three methods:

- Use the front panel discrete input INPUT1, or
- Use a digital control parameter via DeviceNet or local Modbus serial ports, or
- Use a preset time-delay that switches to ZF mode when the time expires.

One important advantage of PFZF control is that it allows a unit to be pre-configured for PFZF control and then operated with no digital communication. A timer or discrete input can change the firing mode.

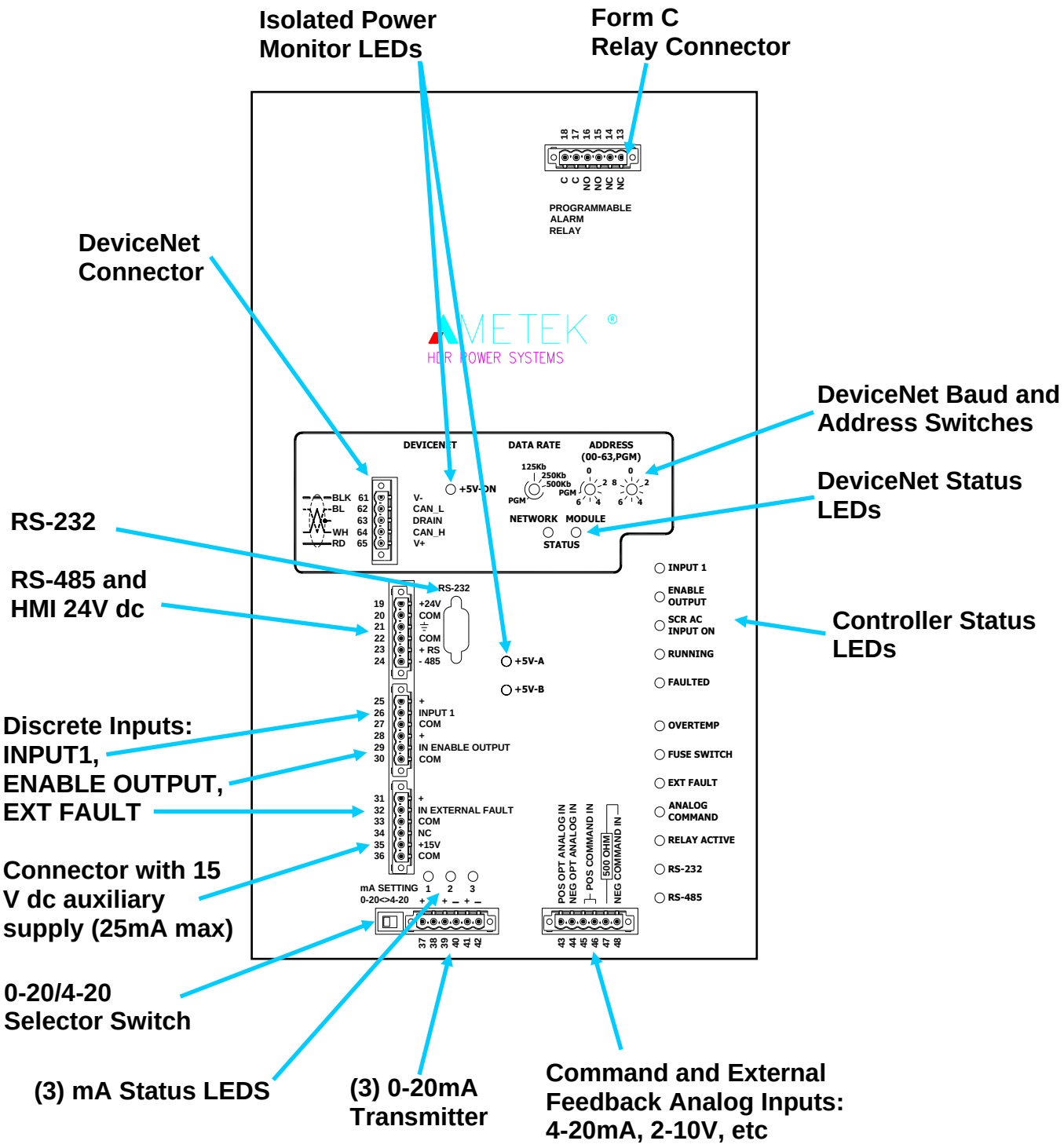
A very typical application would use a load element thermostat to switch the unit to ZF mode when the load element exceeds a specific temperature. With a cold load, the unit would run in PF mode with the benefit of cycle-by-cycle current limiting.

Figure 6 ZFPF Waveform Changing Modes from PF to ZF at 25% Duty Cycle



2.5 Physical Overview

Figure 7 Front Panel



2.6 Specifications

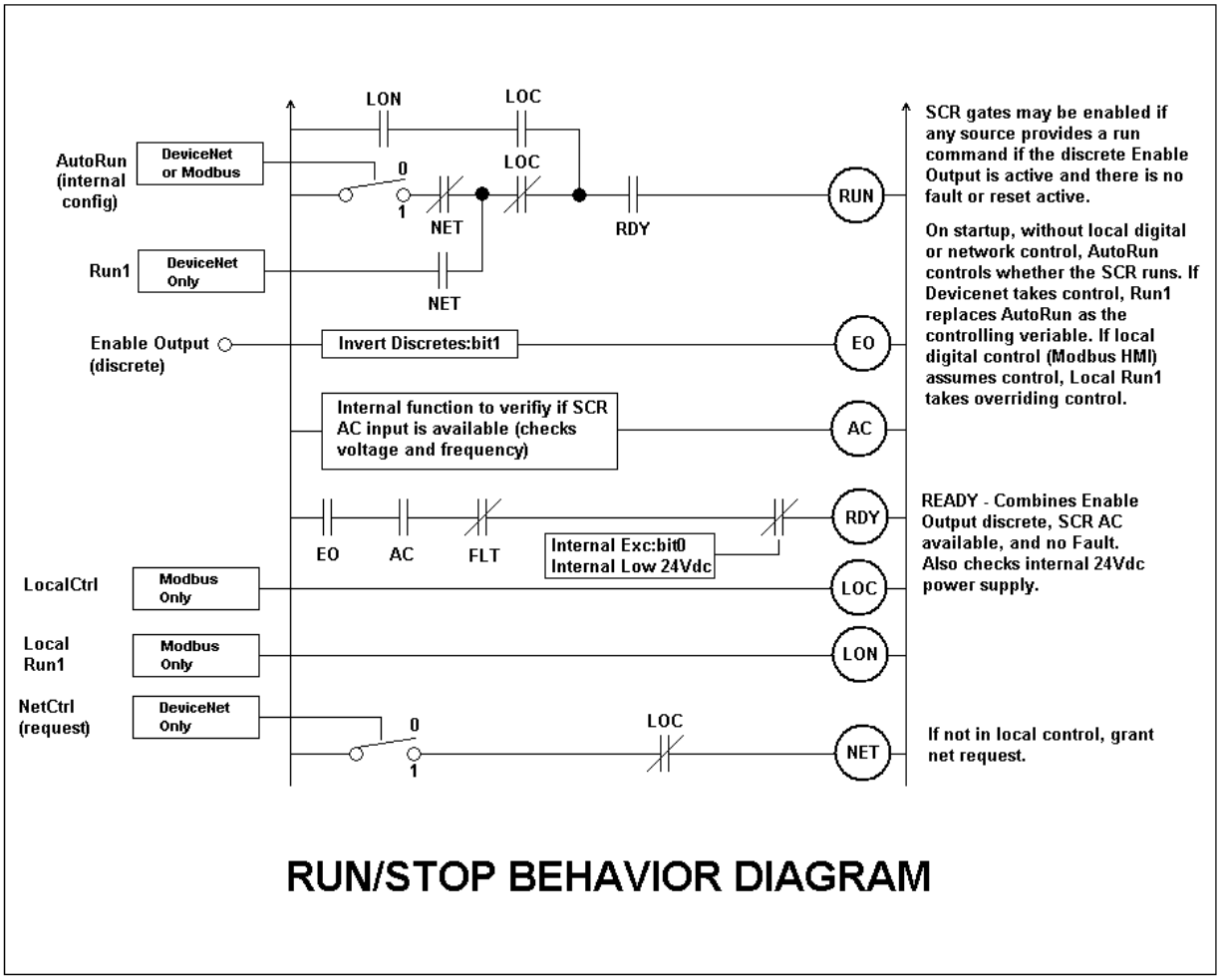
Control Method	Programmable control of back-to-back SCRs including: • PF - Phase Firing • ZF – Zero Firing, Variable Timebase • ZFT – Zero Firing into a Transformer, Fixed Timebase • PFZF – Switchable PF or ZF firing
Voltage Ratings	Isolation transformer primary taps and typical voltage ratings of SCR controller assemblies are: 120, 240, 400, 480, 575 V. 12.25 V ac is the direct input to the MP1 SCR DeviceNet Head.
Frequency Rating	Nominal 50/60 +/-4 (46-64 Hz accepted)
Current Ratings	Typical current ratings of SCR controller assembly CTs are: 60, 90, 120, 180, 225, 350, 500, 650, 800, 1000, 1200 A. 5 A CT secondary is the direct input to the MP1 SCR DeviceNet Head.
Command Setpoint Signal	Controller Setpoint can be provided from three sources: • Front panel analog input • DeviceNet provided setpoint • Front panel serial port setpoint input (two serial ports)
Analog Inputs (2)	1) Setpoint Input: 0-10 V dc, 0-20 mA (using internal 500 ohm resistor. 2) Optional Input: 0-10 V dc. May be used for regulation feedback.
Analog Outputs (3)	Three 0-20 mA or 4-20 mA (switch selectable) transmitters. Transmitted data is programmable for each driver.
Digital Inputs	Switch /Contact control (15 V, 10 mA rated) or 10 V (10 mA) input. External: • INPUT1 – Discrete input point with programmable functions. • ENABLE OUTPUT - Non-alarming output control interlock/reset. • EXTERNAL FAULT – Alarming fault (trip) input. Internal: • Semiconductor fuse switch contact input. • Heatsink thermostat contact input.
Isolation	2500 V ac transformer isolation between utility power and ground or control circuits. +/-500 V dc DeviceNet Port
Voltage Regulation	+/-1% for a +/-10% line voltage change.
SCR Protection	Current surge, semi-conductor fuses, transient protection.
Ambient Temperature	Operating 0-50 °C, Storage –10 – 70 °C
Agency Approval	UL, cUL Listed & CE Compliant

2.7 Catalog Number Explanation

"MP1" is an optional designation to install the **MP1 SCR DeviceNet Head** in place of analog ZF or PF controls. Consult our sales department for details.

2.8 Operation: STOP/RUN Control

Figure 8 Run/Stop Control Logic.



For the unit to run, it must first be ready. This prerequisite requires four things: the internal 24 V dc logic supply must be normal, the discrete ENABLE OUTPUT must be true, the SCR AC INPUT ON must be true, and the unit must NOT be FAULTED.

Once the unit is ready to run, it needs a specific run command. Absent specific control assumed by either DeviceNet or the local control panel (local serial ports), the unit will either remain stopped, or automatically run based on Parameter 195, *AutoRun*. *AutoRun* is stored in nonvolatile memory.

If the DeviceNet master wishes to assume run/stop control, it must request control

using Parameter 128, *NetCtrl*. If granted, the DeviceNet master will control run/stop using Parameter 123, *Run1*. If the local control panel assumes run/stop control, the DeviceNet master will be denied control.

If the local control panel is to take control, it must make the Modbus Coil variable <LocalCtrl> true. It will then have exclusive run/stop control using the Modbus Coil variable <Local Run1>.

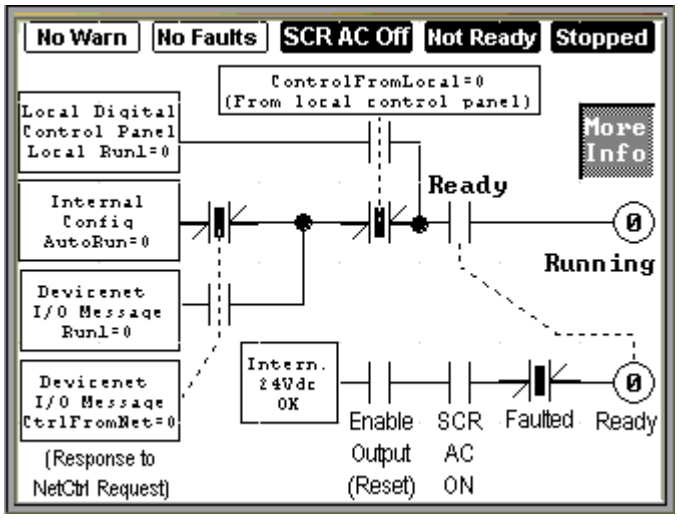
Note that in all cases the run/stop can be stopped by the discrete input ENABLE OUTPUT which allows easy connection to mechanical interlocks. Any fault event, including activation of the discrete EXTERNAL FAULT, is always available to stop and latch off the unit. A FAULTED state requires an explicit reset before the unit will run again. The user may configure the unit to define what generates a FAULTED condition.

A FAULTED condition may be reset several ways. It may be reset by turning the discrete input ENABLE OUTPUT off, then back on, or by sending a digital reset command from the local control panel or via DeviceNet, or by removing all logic power and restarting.

If *AutoRun* is set, the unit will always run automatically, under the control of the discrete input ENABLE OUTPUT without any digital communication. It can also fall back to this discrete control if digital communication is cancelled.

Preview - The HDR mini-HMI panel, configured especially for this controller, can mimic the current state of this diagram with live data, as illustrated here.

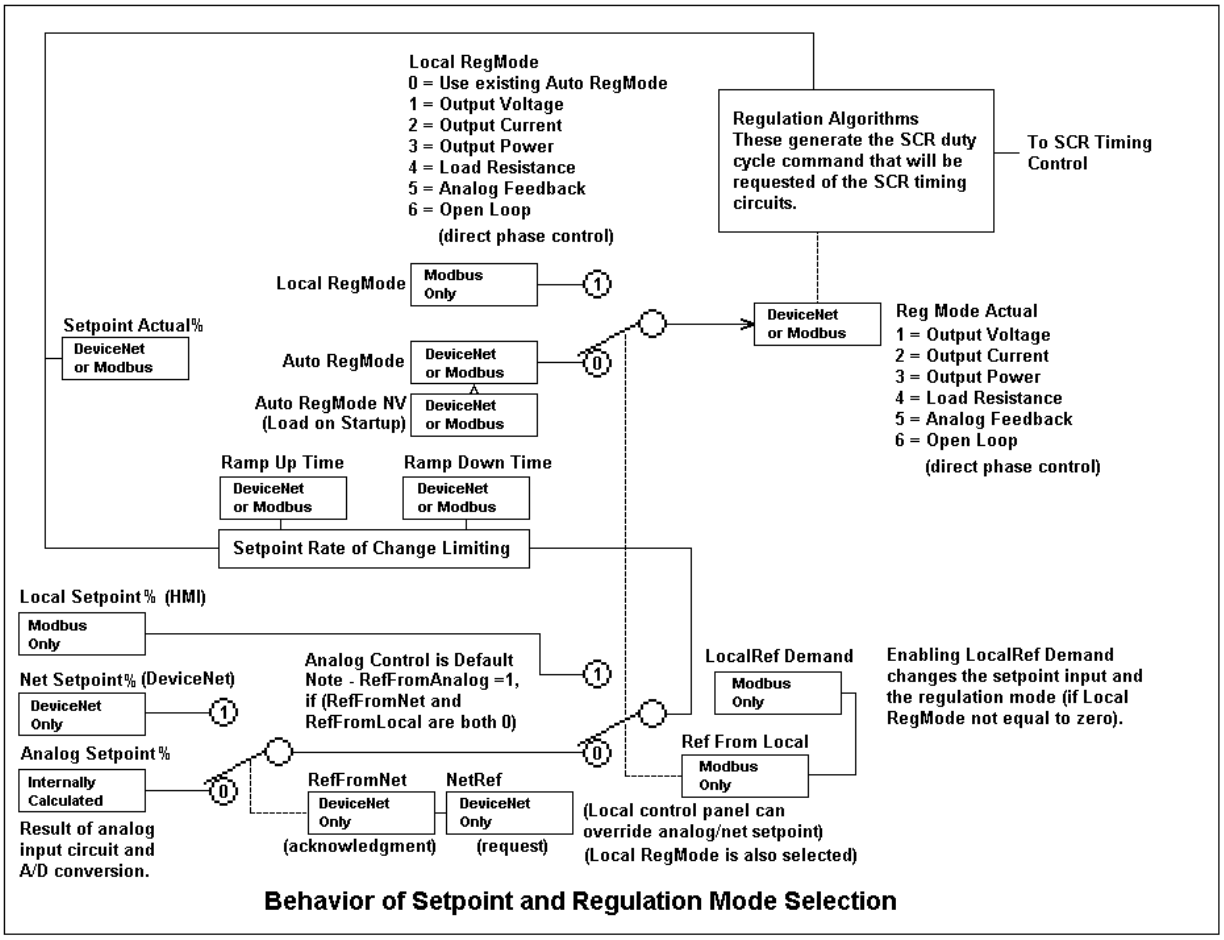
Figure 9 HMI Example Screen of Run/Stop Ladder Diagram.



Next, you will see that the regulation control provides equally powerful setpoint control arbitration, allowing the unit to start, or default back to, a traditional 4-20 mA command setpoint without digital communication while providing the full ability to monitor and/or control the regulation digitally.

2.9 Operation: SCR Regulation Control

Figure 10 Diagram of the Setpoint and Regulation Logic



Setpoint Control – There are three possible sources for the setpoint command. Absent digital control of the setpoint, the controller defaults to traditional analog control using the front panel analog input. The *Analog Setpoint%* is the analog measurement after correction for zero and span (not shown).

If the DeviceNet master wishes control of the setpoint, *NetRef* is used to request control. If control is granted, it will be confirmed using *RefFromNet*. If *RefFromNet* is true, then *Net Setpoint%* becomes the setpoint source. Since the local control panel has higher priority, *RefFromNet* will not be true if <Ref From Local> is true.

The setpoint may also be provided by the local serial ports, which are considered local manual controls from a local control panel. For the local panel to take setpoint control, it requests setpoint control using <LocalRef Demand>. This is acknowledged using <Ref From Local>. If <Ref From Local> is true, the setpoint is provided by the parameter <Local Setpoint%>.

Whatever the setpoint source, it is subjected to rate of change limits controlled by *Ramp Up Time* and *Ramp Down Time*. *Setpoint Actual%* reflects the setpoint after adjustment based on ramp rates

Regulation Mode – *RegMode Actual* reads back the actual regulation mode in use at any time. Auto RegMode is the normal control to select the regulation mode and may be changed at any time. At start-up, *Auto RegMode* is initially loaded with the nonvolatile value *Auto RegMode NV*. After start-up, the network or the local serial ports may change the value of Auto RegMode.

What is regulation mode?

The regulation mode refers to control linearity and what electrical parameter will be approximately linear with the command setpoint.

When using PF - Phase Firing, as the firing mode for the SCRs, there are a variety of regulation modes based on *Reg Mode Actual* including:

- 1 - Output Voltage: Vout RMS will be linear with the setpoint,
- 2 - Output Current: Iout RMS will be linear with the setpoint,
- 3 - Output Power: KWout will be linear with the setpoint,
- 4 - Load Resistance: Phase angle control with compensation for changes in load conductance. This is appropriate for loads such as glass where higher power = higher temperatures = lower resistance,
- 5 - Analog Feedback: External feedback will be linear with command setpoint, (This requires the user to provide an appropriate feedback circuit.)
- 6 - Open Loop: Direct phase angle control (no electrical feedback).

When using ZF – Zero Firing, or ZFT – Zero Firing into Transformer, RegMode Actual only has two definitions: Open Loop or Power Linear line compensation. Zero Firing directly controls the percentage of on-time of the SCRs and results in a power-linear response. (Full sine waves, turned on 50% of the time, will result in 50% power compared to continuous conduction.) If Open Loop regulation is combined with ZF

or ZFT, the SCR on/off ratio is proportional to the setpoint without line compensation. If any regulation value other than Open Loop, is used with ZF or ZFT, the input setpoint is adjusted to compensate for any variation of the input voltage from nominal to maintain the approximate power level that would be obtained if the input line were always equal to nominal. Line voltages may vary throughout the day. Line voltage compensation minimizes the affect of fluctuating line voltages.

Summary - When using ZF – Zero Firing, or ZFT – Zero Firing into Transformer, as the firing mode for the SCRs, there are two regulation modes based on *Reg Mode Actual* including:

- 1-5 - Power linear control with input line voltage compensation,
- 6 - Open Loop: Direct phase angle control (no line compensation).

Auto RegMode NV is normally configured by a user to load *Auto RegMode* with the most appropriate regulation mode needed for best automatic process control for a given application. During commissioning, maintenance, and testing, the user may use the local control panel to take over setpoint control. The regulation mode used for process control may not be best for manual control. The unit provides the option of setting up a separate regulation mode using <Local RegMode> that is only applied when the <LocalRef Demand> takes setpoint control. If <Local RegMode> is set to zero, the unit will continue to use *Auto RegMode* with local setpoint control. If <Local RegMode> is set to a non-zero value, the alternate regulation mode will take over as long as the unit is under local manual setpoint control. When <LocalRef Demand> releases the unit to run under network or analog setpoint control, the regulation mode always switches back to *Auto RegMode*.

Summary - Absent any network or local serial port intervention, the unit will always start and run using the analog command setpoint connected to the front of the unit. The user may limit the slew rate of the actual setpoint by configuring limits for ramp-up and ramp-down times. Absent any network or local serial port intervention, the regulation mode will start and run using the value configured in *Auto RegMode NV*.

If DeviceNet or the local serial ports are used, the analog command input will continue to provide the regulation setpoint unless a digital port explicitly requests control of the setpoint value. DeviceNet may provide a setpoint by writing a value to *Net Setpoint%*. A local control panel may write a setpoint value to <Local Setpoint%> via a local serial port.

Auto RegMode always specifies the regulation mode, unless <Local RegMode> provides an optional mode when a local serial port takes local control of the setpoint.

2.10 Warning, Fault, and Relay Protective/Advisory Functions

The warning, fault, and relay functions are configurable.

A warning flag may be generated for conditions that the user may wish to highlight with a summary warning without generating a fault.

A fault trip will stop SCR gates and requires an explicit reset to continue.

The relay function controls the external Form C relay to control external equipment.

All functions are programmable using bit masks to customize an application by selecting what monitored parameters/conditions will trigger an event.

Refer to the parameter definitions for parameter details. This section explains the interrelationship between parameters that control the warning, fault, or relay.

A later section titled “Monitoring Parameters and Alarms” lists more details of the conditions driving each input parameter or bit flag.

2.10.1 Warning Control Logic

Warning is a summary parameter that monitors a collection of other Boolean flags. It is less serious than a fault because it does not stop the controller.

The table below shows the data controlling a warning. Fifteen Boolean flags are monitored. Each flag is listed in *Warning Mask* and *Warning Status*. *Warning Mask* is configured by the user by setting any bit that will activate a warning. *Warning Status* is the result of each bit of *Warning Mask* ANDed with the monitored value. If a monitored value is "1" and its *Warning Mask* bit is "1", then the corresponding bit in *Warning Status* will also be "1". If any bit in *Warning Status* is "1", then *Warning* is "1".

Table 1 Warning Control Logic

Monitored Parameters #	Name	**Warning Mask (word) Each bit: 0 or 1**	**Warning Status (word) (Input bit AND Mask bit)**	**Result Parameters** #	Name
*	<Comm Fault>	Comm Fault	Comm Fault	153	Warning If Warning Status = 0: 0 = No warning If Warning Status > 0: 1 = Warning true
*	<Comm Idle>	Comm Idle	Comm Idle		
19	Status Auxiliary:b8	High Ambient	High Ambient		
19	Status Auxiliary:b5	SCRShort/OutOpen	SCRShort/OutOpen		
19	Status Auxiliary:b0	Vin RMS High	Vin RMS High		
19	Status Auxiliary:b1	Vin RMS Low	Vin RMS Low		
166	Summary Limiting	Summary Limiting	Summary Limiting		
19	Status Auxiliary:b7	Frequency Deviation	Frequency Deviation		
19	Status Auxiliary:b3	Iin Timed OL	Iin Timed OL	173	WarnCode This stores a code that is a "snapshot" of what event caused *Warning* to go from 0 to 1.
19	Status Auxiliary:b6	SCR Short/w Amps	SCR Short/w Amps		
19	Status Auxiliary:b10	Load Res High (Vout>10%)	Load Res High (Vout>10%)		
19	Status Auxiliary:b11	Load Res Low (Vout>10%)	Load Res Low (Vout>10%)		
19	Status Auxiliary:b9	Fuse Switch Out	Fuse Switch Out		
165	Max Duty Cycle	Max Duty Cycle	Max Duty Cycle		
169	Internal Exc	Internal Exception	Internal Exception		
	None	Reserved	Reserved		

* <Comm Fault> and <Comm Idle> are internal states (they can be monitored as Modbus Coils).

If *Warning Mask* = 0, a warning will never be activated. You may enable more than one bit. If *Warning* is active, read *Warning Status* to quickly determine what conditions are driving it.

Use *Warning* for issues that warrant attention in your application, but do not justify an instant fault trip. The warning flag allows you to monitor one bit and only check conditions in more detail if it becomes true. Many of the conditions monitored by the warning function do not usually justify a fault trip, but *Warning* may be enabled as one input to the *Fault Mask* to expand the conditions that will cause a faulted condition.

2.10.2 Fault Control Logic

A fault condition disables the SCR triggers and requires an explicit reset.

Fault triggering is programmable. The default configuration is that a fault is triggered if the heatsink thermostat is overtemperature, or there is an external fault. The EXTERNAL FAULT discrete input is not programmable and can not be disabled.

The table below shows the data controlling a fault. Fifteen Boolean flags are monitored. Each flag is listed in *Fault Mask* and *Fault Status*. *Fault Mask* is configured by the user by setting any bit that is to cause a fault. *Fault Status* is the result of each bit of *Fault Mask* ANDed with the monitored value. If a monitored value is "1" and its *Fault Mask* bit is "1", then the corresponding bit in *Fault Status* will also be "1". If any bit in *Fault Status* is "1", then *Faulted* is "1".

Table 2 Fault Control Logic

Monitored Parameters #	Name	**Fault Mask (word) Each bit: 0 or 1**	**Fault Status (word) (Input bit AND Mask bit)**	**Result Parameters** #	Name
167	INPUT1 Discrete	INPUT1 (discrete)	INPUT1 (discrete)	152	Faulted If Fault Status = 0: 0 = Not faulted If Fault Status > 0: 1 = Faulted
19	Status Auxiliary:b4	Heatsink OT	Heatsink OT		
19	Status Auxiliary:b8	High Ambient	High Ambient		
19	Status Auxiliary:b5	SCRShort/OutOpen	SCRShort/OutOpen		
19	Status Auxiliary:b0	Vin RMS High	Vin RMS High		
19	Status Auxiliary:b1	Vin RMS Low	Vin RMS Low		
	None	Reserved6	Reserved6		
19	Status Auxiliary:b2	Iin Peak Fault	Iin Peak Fault		
19	Status Auxiliary:b3	Iin Timed OL	Iin Timed OL	174	FaultCode This stores a code that is a "snapshot" of what event caused *Faulted* to go from 0 to 1.
	None	Reserved9	Reserved9		
	None	Reserved10	Reserved10		
**	<Comm Fault>	Comm Fault	Comm Fault		
**	<Comm Idle>	Comm Idle	Comm Idle		
153	Warning	Warning	Warning		
19	Status Auxiliary:b15	*External Fault (discrete)	External Fault (discrete)		
	None	Reserved	Reserved		

* External Fault bit of Relay Mask always equals "1".
** <Comm Fault> and <Comm Idle> are internal states (they can be monitored as Modbus Coils).

Fault Mask is never "0", External Fault bit is always "1". You may enable more than one bit. *Fault Mask* bits for Comm Fault and Comm Idle are automatically set and cleared based upon *NetFaultMode* and *NetIdleMode*. If Faulted is "1", read *Fault Status* to quickly determine what conditions are driving it. *Iin Peak Fault* and Iin *Timed OL* are latched and persists after the event passes.

Examples:

- Enable *Fault Mask: Warning*, then Parameter 153, *Warning*, also triggers a fault. This increases the number of conditions that can trigger a fault.
- Enable *Fault Mask: INPUT1*, then the INPUT1 discrete input becomes another, separately identifiable, external fault discrete input.

IMPORTANT

Use great care when deciding what inputs to enable in the Fault Mask especially when continuity of power is important.

A fault trip is very appropriate to stop the unit as a supplemental safety step and to prevent/limit equipment damage during a process malfunction.

Avoid enabling input conditions that will cause nuisance trips or will prevent the controller from running when you intend to run. For any enabled input, plan how you will detect and confirm the cause of a trip before resetting. A reset is not possible if an active/enabled input exists.

WARNING

Identify the cause of a fault before resetting.

USE GREAT CARE before resetting faults remotely using DeviceNet or the local Modbus serial ports connected to remote computers. DO NOT program a PLC to automatically reset all faults unless the fault diagnostic process has been designed with this function in mind.

Resetting a unit into a seriously faulted (shorted) load can cause serious damage to the load, controller, and other equipment.

Remote and automated resets may be appropriate when less serious faults are detected, identified, and cleared remotely before resetting the controller.

DO NOT USE the fault feature as the only mechanism for personnel safety.

Even when a controller is in a Faulted (tripped) condition, lethal voltages may exist at the output, up to and including full input line voltage.

Limited AC current will always flow through the RC snubber around the SCRs.

A Faulted unit cannot shut off output power if the SCRs are shorted, or if there is a logic failure.

2.10.3 Relay Control Logic

The relay function controls the external Form C relay on the front panel. The default configuration is that the relay is active whenever the unit is faulted. The user may choose to use the relay for other purposes by changing the conditions that can activate the relay. For example, the relay may be controlled as a discrete output point for the network.

The table below shows the data controlling the relay. Fifteen Boolean flags are monitored. Each flag is listed in *Relay Mask* and *Relay Status*. *Relay Mask* is configured by the user by setting any bit that will activate the relay. *Relay Status* is the result of each bit of *Relay Mask* ANDed with the monitored value. If a monitored value is "1" and its *Relay Mask* bit is "1", then the corresponding bit in Relay Status will also be "1". If any bit in *Relay Status* is "1", then Relay State is active.

Table 3 Relay Control Logic

Monitored Parameters #	Name	**Relay Mask (word) Each bit: 0 or 1**	**Relay Status (word) (Input bit AND Mask bit)**	**Result Parameters** #	Name
167	INPUT1 Discrete	INPUT1	INPUT1	163	Relay State If Relay Status = 0: then Relay State = 0 (Not active) If Relay Status > 0: then Relay State = 1 (Active)
19	Status Auxiliary:b4	Heatsink OT	Heatsink OT		
19	Status Auxiliary:b8	High Ambient	High Ambient		
19	Status Auxiliary:b5	SCRShort/OutOpen	SCRShort/OutOpen		
19	Status Auxiliary:b0	Vin RMS High	Vin RMS High		
19	Status Auxiliary:b1	Vin RMS Low	Vin RMS Low		
153	Warning	Warning	Warning		
19	Status Auxiliary:b7	Frequency Deviation	Frequency Deviation		
152	Fault	Fault	Fault	175	RelayCode This stores a code that is a "snapshot" of what event caused *Relay State* to go from 0 to 1.
19	Status Auxiliary:b6	SCR Short/w Amps	SCR Short/w Amps		
19	Status Auxiliary:b10	Load Res High (Vout>10%)	Load Res High (Vout>10%)		
19	Status Auxiliary:b11	Load Res Low (Vout>10%)	Load Res Low (Vout>10%)		
19	Status Auxiliary:b9	Fuse Switch Out	Fuse Switch Out		
*	<Local Relay Req>	Local Relay Req	Local Relay Req		
124	Remote Relay Req	Remote Relay Req	Remote Relay Req		
	None	Reserved	Reserved		

* <Local Relay Req> is a Modbus Coil value that can only be changed via the Modbus ports.

If *Relay Mask* = 0, the relay will never be activated. You may enable more than one bit. If the relay is active, read *Relay Status* to quickly determine what conditions are driving it.

Examples:

- Enable *Relay Mask: Fault bit,* then the relay activates when the unit is faulted.
- Enable *Relay Mask: INPUT1*, then the relay is a slave to the INPUT1 discrete input.
- Enable *Relay Mask: Remote Relay Req*, then the relay is a discrete output point for DeviceNet under direct PLC control.

2.11 Monitoring Parameters and Alarms

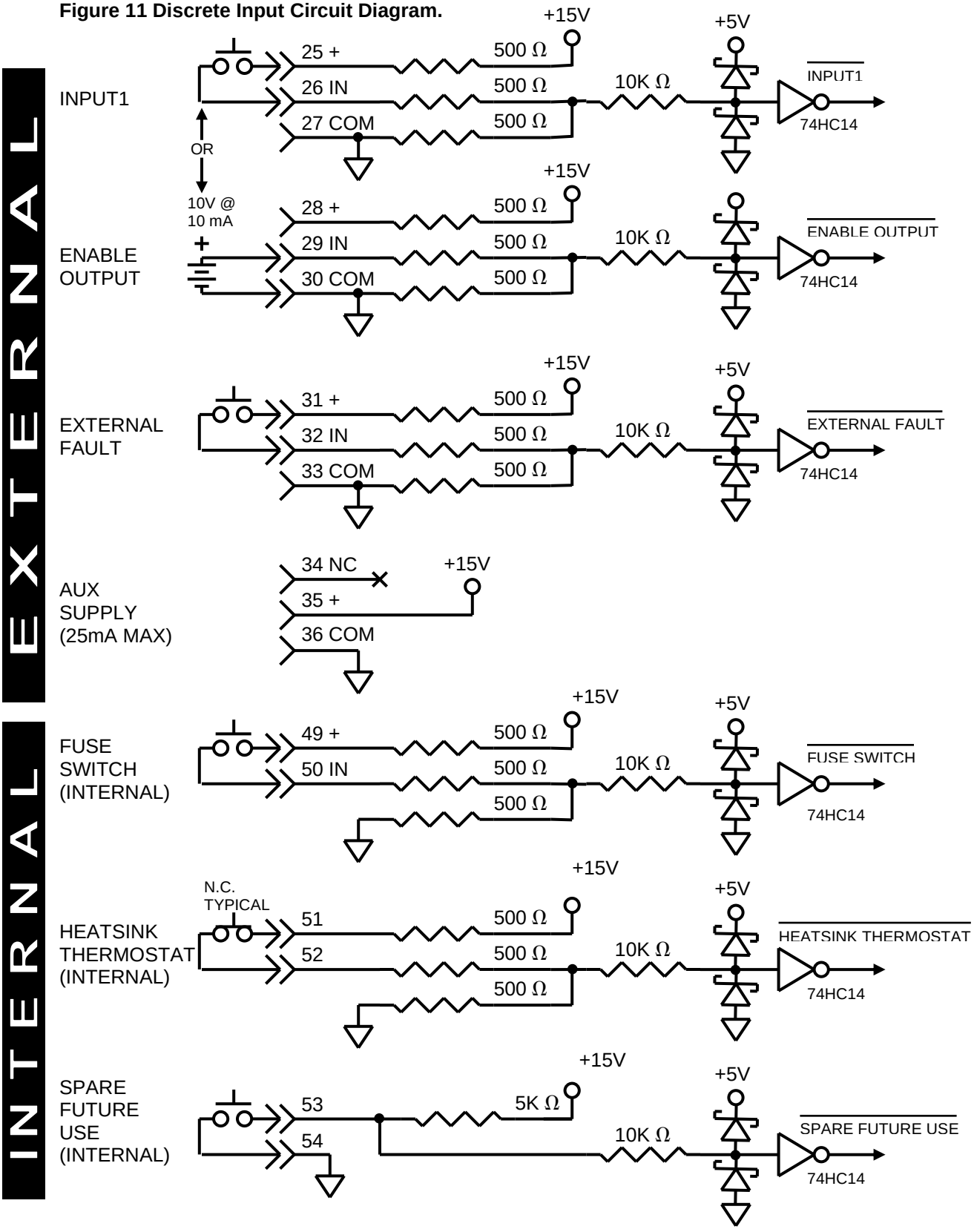
The previous section lists many conditional flags used to program the operation of Warning, Fault, and the Relay. Some of these flags are the result of a monitored parameter being compared to an alarm setpoint. The list below highlights the metering parameters and the alarm settings that may be used to generate these flags.

Parameter Name or Bit Name of Flag	**Conditions that will control or set each bit.** Parameter names in **BOLD** are used to configure an alarm setpoint.
Faulted	Set if any bit of 'Fault Status' is set.
Warning	Set if any bit of 'Warning Status' is set.
Running1	See "Operation: STOP/RUN Control".
SCR AC In Status	SCR input voltage is > 50% of nominal AND its frequency is within 46-64Hz.
Ready	See "Operation: STOP/RUN Control".
CntlFromNet	See "Operation: STOP/RUN Control".
RefFromNet	See "Operation: SCR Regulation Control".
At Setpoint	For most regulation modes, this indicates the regulated parameter is within 1% of the desired setpoint. For ZF or ZFT zero fire modes, it indicates the duty cycle is within 1% of the desired setpoint after line voltage correction of the desired setpoint. For Open Loop control, it indicates that the duty cycle is within 1% of the desired setpoint.
CtrlFromLocal	See "Operation: STOP/RUN Control".
RefFromLocal	See "Operation: SCR Regulation Control".
RefFromAnalog	See "Operation: SCR Regulation Control".
Relay State	Set if any bit of 'Relay Status' is set.
Enable Output	Direct Discrete Input.
Max Duty Cycle	DutyCycle Actual is at 100%.
Summary Limiting	Iin Limiting' = 1 OR 'Iout Limiting' = 1 OR 'Vout Limiting' = 1 OR 'KWout Limiting'
INPUT1 Discrete	Direct Discrete Input.
Vin RMS High	'Vin Actual RMS%' > **'Vin High%'**.
Vin RMS Low	'Vin Actual RMS%' < **'Vin Low%'**.
Iin Peak Fault	(Disabled if 'Iin PeakFault%' = 0) If 'Iin Actual Peak' > **'Iin PeakFault%'** for 2 cycles, then the SCR control resets and forces the output to walk up from zero. Each PeakFault reset is counted internally. If the count exceeds **'Iin Peak Retry'** within the time set by **'Iin Peak Timer'**, then this flag is set. This alarm must be enabled in the 'Fault Mask' or unlimited resets are possible. This flag is reset in the same way as a the 'Faulted' alarm, even if the unit is not faulted.
Iin Timed OL	'Iin Actual RMS%' > **'Iin RMS OL%'** continuously for a time greater than **'Iin RMS OL Timer'**.
Heatsink OT	Direct Discrete Input.

SCRShort/OutOpen	SCR control not running, but 'Vout Actual RMS%' > 75% for 4 seconds. This may be caused by a shorted SCR, but is more likely to be an open output (no load connected). The RC snubber in parallel with the SCRs always conducts a small amount of current.
SCR Short/w Amps	SCR control not running, but 'Iout Actual RMS%' > 5% for 4 seconds. Anomalous condition requiring investigation to determine cause of measured current when SCR gates are off.
Freq Deviation	|'Frequency Actual' - 'Nom Input Freq'| > **'Freq Deviation'**. 'Nom Input Freq' is automatically set to 50.0 or 60.0 when the SCR AC input is available.
High Ambient	'Ambient Temp C' > **'Ambient OT Limit'**.
Fuse Switch Out	Direct Discrete Input.
Load Res High	'Resistance Ratio' > **'Res Ratio High'** AND 'Vout Actual RMS%' > 10%.
Load Res Low	'Resistance Ratio' < **'Res Ratio Low'** AND 'Vout Actual RMS%' > 10%.
--Factory--	
--Factory--	
Optional Intern Input	Direct Discrete Input. (Internal use only)(not used)
External Fault	Direct Discrete Input.
Iin Limiting	PF, Phase Fire Mode: 'Iin RMS% Limit' is actively limiting output. This overrides normal regulation. ZF or ZFT, Zero Fire: 'Iin Actual RMS% > 'Iin RMS% Limit', flag only, no limiting.
Iout Limiting	PF, Phase Fire Mode: 'Iout RMS% Limit' is actively limiting output. This overrides normal regulation. ZF or ZFT, Zero Fire: 'Iout Actual RMS% > 'Iout RMS% Limit', flag only, no limiting.
Vout Limiting	PF, Phase Fire Mode: 'Vout RMS% Limit' is actively limiting output. This overrides normal regulation. ZF or ZFT, Zero Fire: 'Vout Actual RMS% > 'Vout RMS% Limit', flag only, no limiting.
KWout Limiting	PF, Phase Fire Mode: 'KW Output% Limit' is actively limiting output. This overrides normal regulation. ZF or ZFT, Zero Fire: 'KWout Actual%' > 'KW Output% Limit', flag only, no limiting.
Comm Fault	Monitors internal state of DeviceNet activity.
Comm Idle	Monitors internal state of DeviceNet activity.

2.12 Inputs: Discrete Inputs

Figure 11 Discrete Input Circuit Diagram.



The external discrete inputs (INPUT1, ENABLE OUTPUT, and EXTERNAL FAULT) may be used with either a switch/contact or 10 V dc input.

When used with a switch or contact, connect the contact from the "+" terminal to the signal input. When used with a 10 V dc input, connect the voltage between the signal input (+) and the "COM"(-) terminal.

The table below summarized the external user connections.

Figure 12 External Discrete Input Terminals

Terminal Number	Name	Contact/Switch (15V, 10 mA)	10 V dc Source (10 mA)
26	INPUT1	Connect 25-26	+ to 26 - to 27
29	ENABLE OUTPUT	Connect 28-29	+ to 29 - to 30
32	EXTERNAL FAULT	Connect 31-32	+ to 32 - to 33

The internal discrete inputs are also shown in the drawings for FUSE SWITCH, and HEATSINK THERMOSTAT. The user should be aware of how these are connected and the communication parameters available to the user. See the next subsections.

INVERT DISCRETES – Parameter 140, *Invert Discretes* is a bit-mapped 16-bit word used to program the logic of the discrete inputs (and discrete output relay). To provide a flexible custom interface, the user may invert or not invert the logic of each discrete input. The value of each bit depends on whether the input terminal is low or high (0V or 10V) in the active state. *Invert Discretes* may be configured using either DeviceNet or the local Modbus serial ports.

The user may also monitor the final logic (0 or 1) of each discrete input. The communication section will identify the specific DeviceNet parameter or Modbus Coil assigned to each discrete input.

The Status Indicators section will also describe LEDs used to monitor the state of discrete inputs. The LEDs reflect the state of the discrete inputs combined with the configuration of *Invert Discretes*.

2.12.1 INPUT1 Programmable Discrete Input

INPUT1 is a general purpose discrete input with some programmable functions.

The state of INPUT1 may be monitored using Parameter 167, *INPUT1 Discrete*, or *<INPUT1>*. The input logic of INPUT1 may be inverted using Parameter 140, *Invert Discretes*. The front panel LED labeled INPUT1 will turn on when INPUT1 is true. If nothing else, INPUT1 may be used as a discrete input point to monitor any external switch for the network.

INPUT1 is one input bit that may be enabled in Parameter 138, *Fault Mask*. If enabled, a faulted condition is triggered if INPUT1 is true. When used in this way, INPUT1 would be a separately identifiable trigger for a fault (in addition to the discrete input EXTERNAL FAULT).

INPUT1 is one input bit that may be enabled in Parameter 139, *Relay Mask*. If enabled, the relay will change to the active state whenever INPUT1 is true.

PFZF firing mode is selected if Parameter 55, *Firing Mode Sel*, equals 5. In this mode, the discrete INPUT1 is used to switch the unit from phase firing to zero firing.

2.12.2 Enable Output Discrete Input

ENABLE OUTPUT is a non-alarming discrete input that must be true to allow the controller to be ready to run. The state of ENABLE OUTPUT may be monitored using Parameter 164, *Enable Output*, or <*Enable Output*>. The input logic of *ENABLE OUTPUT* may be inverted using Parameter 140, *Invert Discretes*. The front panel LED labeled *ENABLE OUTPUT* will turn on when *ENABLE OUTPUT* is true.

If all other conditions exist for the unit to run, ENABLE OUTPUT may be used as a local discrete run/stop control by controlling the value of Parameter 156, *Ready*.

ENABLE OUTPUT has one secondary function. If the unit is in a faulted state, changing ENABLE OUTPUT to false will reset the fault (if the cause of the fault is gone). The unit will remain not ready as long as ENABLE OUTPUT is false and again be made ready when ENABLE OUTPUT is change to true.

2.12.3 External Fault Discrete Input

The discrete input EXTERNAL FAULT is dedicated as an external fault control.

The input logic of EXTERNAL FAULT may be inverted using Parameter 140, *Invert Discretes*. For applications requiring fail-safe fault trip wiring, invert the logic so that a jumper loop must always be attached to EXTERNAL FAULT for the unit to run. The front panel LED labeled EXT FAULT will turn on when EXTERNAL FAULT is true.

EXTERNAL FAULT is one input to Parameter 138, *Fault Mask*. Unlike all other inputs to *Fault Mask*, its mask bit may not be disabled.

The controller can never run if the EXT FAULT LED is on. A fault condition cannot be reset if EXTERNAL FAULT is true.

2.13 Inputs: Analog Input

The unit has two analog inputs.

The analog setpoint input for controller regulation is labeled “COMMAND IN” input is on terminals 45-48. The input is rated for 0-10 V dc, but an internal 500-ohm resistor may be added using a jumper between terminals 46-47 for a mA input.

The optional feedback input labeled “OPT ANALOG IN” analog input may be used for an external feedback voltage. If a mA feedback signal is required, then an external 500-ohm resistor must be added between terminals 43-44. External feedback may be used if an external value, that is proportional to SCR output voltage, is to be regulated. For example, this might be used if the SCR output level controls the frequency of a high power oscillator.

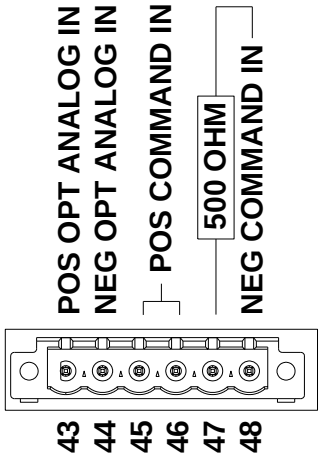
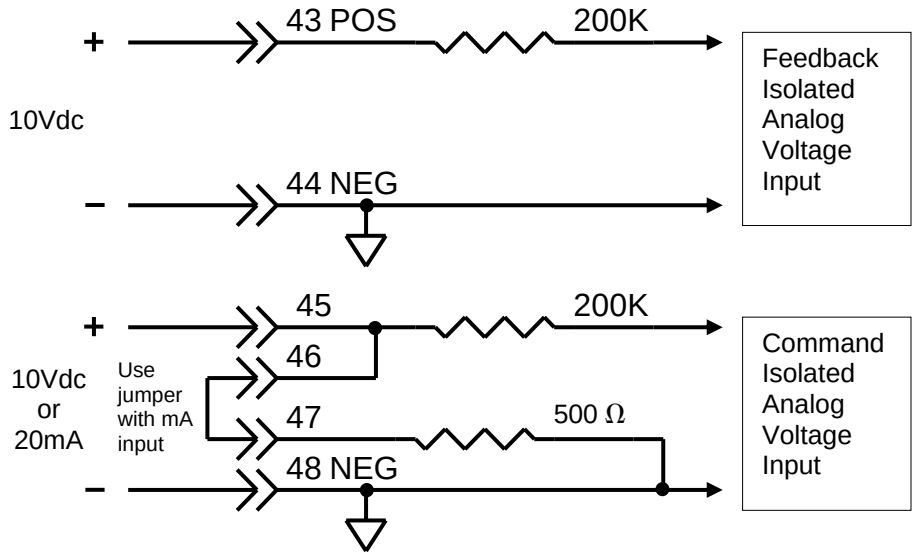


Figure 13 Analog Input Terminals

The “OPT ANALOG IN” analog input may also be used as a general-purpose analog input point.

The “NEG” terminals are connected together, but are isolated from the “COM” of other front panel connectors.

Figure 14 Analog Input Terminals



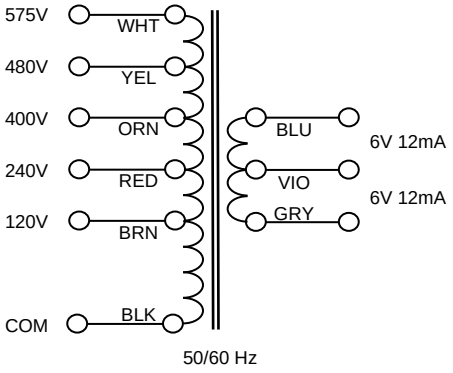
The analog inputs must be calibrated to match the transmitted signal. The value parameters for these two inputs are Parameter 222, *Analog Feedback%*, and Parameter 218, *Analog Setpoint%* . Zero and Span settings are normally be used to produce a value of 0-10000, representing 100.00%. These values are signed integers so that values below zero may be monitored during calibration. For example, when calibrated to use with a 4-20 mA input, 0 mA would be about –2500 (-25.00%), 4 mA would be 0, and 20 mA would be 10000 (100.00%). (When used for regulation, the negative values are all clamped at zero internally.)

2.14 Inputs: SCR Voltage and Current Measurement (Internal)

These are internal connections for a complete SCR controller. For the MP1 SCR DeviceNet Head, these are connections that must be made to the SCR assembly.

CAUTION: The primary side of the isolation transformer connects to the high voltage supplying the SCRs. Verify that all utility voltage to the controller is disconnected before attempting any wiring changes within the controller or between the MP1 SCR DeviceNet Head and the SCR mechanical assembly.

Transformer isolation is used for both current and voltage measurement. The rated secondary voltage and current from the voltage transformer and current transformer are defined as the nominal 100.00% level for measurement.



Voltage measurement – Terminals to a multi-tap transformer allow connection to a wide range of voltages. If a non-standard voltage is used, use the closest tap, but the nominal line voltage should not be higher than the tap voltage. When the primary voltage matches a tap combination, minimal calibration is needed. If the voltage is lower than the tap, more calibration will be needed.

Figure 15 Voltage Potential Transformer

Other tap combinations may also be used by moving the COM connection to a higher tap. These possible ratings are possible with these tap combinations.

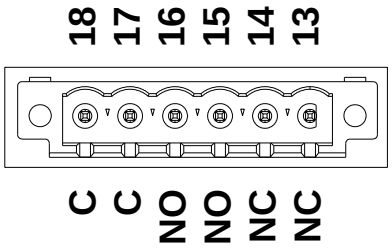
VAC	Lower Tap		Higher Tap
280	120	to	400
360	120	to	480
455	120	to	575
160	240	to	400
335	240	to	335
80	400	to	480
175	400	to	575
95	480	to	575

Current Measurements – Current measurements use standard 5A current transformers. The standard values uses include 60, 90, 120, 180, 225, 350, 500, 650, 800, 1000, 1200A.

Refer to a complete unit wiring schematic for details of the installed wiring for these connections.

2.15 Output: Programmable Relay

One programmable Form C relay is provided. While commonly used when a controller is FAULTED (tripped), the relay may also be used for other custom purposes. Uses might include tripping a larger contactor, turning on a remote enunciator or alarm beacon, or as an input to PLC.



NOTE: Parameter 140, *Invert Discretes*, is used to invert the logic of the relay control. The default configuration is for the relay to be energized only in the active state. This may be inverted for applications that require a fail-safe relay that is normally energized and is only de-energized in the active state, or when all power is lost.

Figure 16 Relay Terminals.

The RELAY ACTIVE LED indicates when the relay is in the active state.

A variety of events may be programmed to activate the relay. They include:
INPUT1 is active, INPUT1 LED will be on in this case,
Heatsink OT, as measured by the heatsink thermostat
High Ambient, high inside ambient temperature on the DSP board,
SCRShort/OutOpen, high output voltage when SCR gates are off,
Vin RMS High,
Vin RMS Low,
Warning, Warning is a summary of other possible alarms,
Frequency Deviation, from nominal,
Faulted, indicating the unit is in the FAULTED state and the FAULTED LED is on,
SCR Short/w Amps, high output current when SCR gates are off,
Load Resistance High (if Vout also >10%),
Load Resistance Low (if Vout also >10%),
Fuse Switch Out, FUSE SWITCH LED will also be on,
Local Relay Req, local digital request received from the local serial ports,
Or Remote Relay Req, network relay request from DeviceNet I/O message.

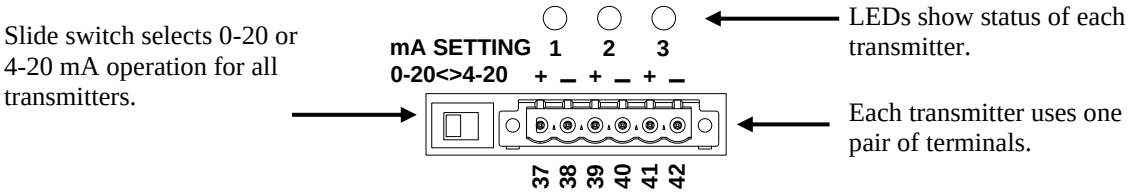
A configurable bit mask is used to select which items can activate the relay. Any combination is allowed. The relay remains active as long as at least one mask enabled flag is true. Warning and Faulted are summary flags that expand the number of flags that can actually activate the relay.

The default configuration is to only activate the relay when the unit is in the FAULTED condition. Alternatively, the relay could also be used as a direct Form C slave relay controlled by the INPUT1 discrete input, or as an output point controlled by DeviceNet or data received on local serial ports.

Because the relay can be a direct slave to a network PLC, a PLC could apply any proprietary algorithm to determine when the local relay will be activated.

2.16 Output: Analog Output, 0-20 mA Transmitters

Figure 17 0-20/4-20 mA Transmitter Terminals



Three mA transmitters are provided. A front panel slide switch is used to select either 0-20 or 4-20 mA operation. One +/- terminal pair is used for each transmitter. Each transmitter has a status LED.

Analog mA Transmitter LEDS – LEDs 1, 2, 3 correspond to the mA transmitters on terminals 37-38, 39-40, and 41-42. If a transmitter is powered, its LED will always be either RED or GREEN.

GREEN indicates that the transmitter output matches its digital data command. Even if the output is unconnected, the LED may remain green if it is attempting to transmit 0.0 mA.

RED indicates that the transmitter output does not match its digital data command because the load resistance is so high that it has reached its highest compliance voltage before reaching the desired current. (This will normally happen if the user does not attach the output to a mA receiver or resistor.) A transmitter is capable of driving 15V signal into a 750-ohm load when transmitting the maximum 20 mA signal. Open circuit voltage may be as high as 24 V dc.

Transmitters – Each transmitter is composed of a 16-bit DAC with a mA analog transmitter section capable of driving up to 750 ohms at 15 V dc. The transmitters do not require calibration.

Scaling – The slide switch selects 0-20 or 4-20 mA operation. This determines whether a transmitter will transmit 0-20 or 4-20 mA when the DAC input data varies from 0 to 65535. Each transmitter may be configured to transmit a variety of data. When used as a direct network analog output point, the network can drive the transmitter with a 16-bit value, or 0 to 65535. More commonly, the transmitter may be used to transmit an internal controller parameter.

Most controller parameters are scaled from 0 to 100% when the 100% point is

defined as the nominal rating of the controller. This 0 to 100% value is scaled to 0 to 65535 to run the transmitter from the minimum to maximum value. Depending upon the parameter, the parameter may be able to generate data much greater than 100%. For example, 100% current output is defined as current matching the current rating of the controller. If the user wants the transmitter to show a signal greater than 100% of the controller rating, the full scale value may be set lower than 65535.

For example, if the user configures the transmitter to transmit output current and the full scale is set to 32767 with the slide switch in the 0-20 mA position, the output current will range from 0 to 10 mA when the output current goes from 0 to 100%. If the controller is overloaded to 150%, then the transmitter output will increase to 15 mA.

The parameters *DAC Out1 Select, DAC Out2 Select, and DAC Out3 Select* are used to select the data source for each transmitter. The parameters value may be 0 to 65535 and are defined here:

0 = Fixed 0mA output (disabled)
1 = Vin Actual RMS%
2 = Iin Actual RMS%
3 = KVAin Actual%
4 = Vout Actual RMS%
5 = Iout Actual RMS%
6 = KWout Actual%
7 =Analog Setpoint%
8 = Analog Feedback%
9 = Setpoint Actual%
10 = DutyCycle Actual%
11 = DAC Out1 Ref
16383 = Fixed 25%
32767 = Fixed 50%
49151 = Fixed 75%
65535 = Fixed 100%

The EDS provides the above non-consecutive enumeration. Any 16-bit value is allowed (but reserve 12-31 for future use). Values 1-11 steer other parameters to be the data source to drive the DAC. Values 0, and 12-65535 are used as direct, fixed data to drive the DAC creating a fixed mA source. RSNetWorx™ may not allow entering values not enumerated.

"1-10" are controller monitoring parameters. The user may configure the mA current scaled to represents 100% using these parameters. Parameters *DAC Out1 FS*, *DAC Out2 FS*, and *DAC Out3 FS* will set the 16-bit DAC input level that is scaled to match 100%.

"11" defines the data source to be parameters *DAC Out1 Ref*, *DAC Out2 Ref*, or *DAC Out3 Ref*. This makes the mA transmitters available as general analog output points. Either DeviceNet or the local serial ports may write to these reference parameters to control the mA data.

"12-31" are reserved. Any other value including "0" and "32-65535" will set the transmitter to be a fixed mA value. The current level is controlled by the same number. For example, setting *DAC Out1 Select* =equal to 32768 will set the mA output at the 50% point. This may be either 10 or 12 mA depending upon whether the slide switch selects 0-20 or 4-20 mA operation. Fixed mA operation is primarily for testing, but may have some custom applications.

Parameters *DAC Out1 Actual*, *DAC Out2 Actual*, and *DAC Out3 Actual* may be monitored if the user wishes to confirm what data is being sent to the 16-bit DAC.

2.17 Output: SCR Gates (Internal)

The MP1 SCR DeviceNet Head is mated with an SCR driver board that converts a digital signal to a transformer-isolated, high-frequency gate pulse for direct connection to the SCR gates and cathodes. These connections are all internal on a complete SCR controller. They must be connected when building a controller using the MP1 SCR DeviceNet Head.

2.18 Status Indicators

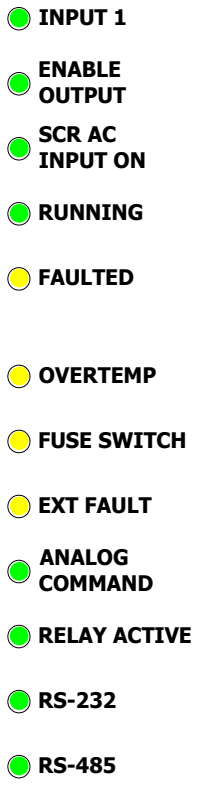
Note about description below: Parameter 140, *Invert Discretes*, may be used to invert the default logic of the user's discrete inputs (INPUT1, ENABLE OUTPUT, EXT FAULT). These inputs have pull-down resistors. With the default logic, the input is considered OFF (0 or FALSE) when the terminal is open or 0 V dc is applied. If the input logic were inverted on any input to accommodate the interface to custom hardware, the related description would be reversed.

INPUT1 LED – This directly reflects the status of the INPUT1 programmable discrete input. If INPUT1 (Term. 26) is LOW (0V or open connector), the LED is off. If INPUT1 is High (10V from Term.26-27 or closed contact from Term.25-26), then the LED will be ON.

ENABLE OUTPUT - This directly reflects the status of the ENABLE OUTPUT discrete input. If ENABLE OUTPUT (Term. 29) is LOW (0V or open connector), the LED is off. If ENABLE OUTPUT is High (10V from Term.29-30 or closed contact from Term.28-29), then the LED will be ON. ENABLE OUTPUT must be on as one condition for the controller to be ready to run.

SCR AC INPUT ON – This LED indicates if acceptable AC voltage is applied to the SCR power input connection. AC must be applied to the SCR input and this light must be ON as one prerequisite for the controller to be ready to run.

RUNNING – If this LED is ON, SCR gates are enabled and the controller is running the SCRs. Running requires a run command (from the controlling path) and ENABLE OUTPUT is ON, and SCR AC INPUT is ON, and the unit is NOT FAULTED (FAULTED LED OFF).



F
igure 18 LEDs

FAULTED – If this LED is ON, the unit is in a FAULTED state and the controller will not run. A fault must be reset and this light must be OFF as one condition for the unit to be ready to run.

OVERTEMP – This indicates an over temperature alarm from either the heatsink thermostat or the ambient overtemp alarm, which measures the inside ambient temperature on the DSP board.

Parameter 43, *Ambient OT Limit*, is the configured setpoint for the ambient over temperature setting.

The heatsink thermostat connects to an internal discrete input terminal. The standard

heatsink thermostat is normally open; therefore, Parameter 140, *Invert Discretes*, will be configured to not invert this internal discrete input.

FUSE SWITCH – This turns on if the internal semiconductor fuse switch is in the tripped position. The default configuration is to connect this to the Normally Open contacts of the switch. This does not confirm if the fuse is actually blown. The switch can be moved to the tripped position manually for testing.

EXT FAULT – This directly reflects the status of the EXTERNAL FAULT discrete input. If EXTERNAL FAULT (Term. 32) is LOW (0V or open connector), the LED is off. If EXTERNAL FAULT is High (10V from Term.32-33 or closed contact from Term.31-32), then the LED will be ON.

EXTERNAL FAULT is a non-maskable input that will cause the FAULTED lamp to turn on and stop the controller gates. A FAULTED condition may never be reset if EXT FAULT LED is on.

ANALOG COMMAND – This LED is on whenever the controller command comes from the front panel analog input terminals 45(+) and 48(-). If the controller is running with this LED off, then the regulation command is digital from either the network or the front serial ports.

RELAY ACTIVE – This indicates that the front panel Form C relay at terminals 13-18 is in the active state.

The relay is programmable, so there are multiple conditions that may cause the relay to become active.

NOTE: Parameter 140, *Invert Discretes*, is also used to invert the logic of the relay control. The default configuration is for the relay to be energized only in the active state. This may be inverted for applications that require a fail-safe relay that is normally energized and is only de-energized in the active state, or when all power is lost. Therefore, this LED indicates the relay is active, not whether it is energized or not.

RS-232 – This is an activity LED for the RS-232 port that turns on whenever the port is receiving, sending, or processing any serial data.

RS-485 - This is an activity LED for the RS-485 port that turns on whenever the port is receiving, sending, or processing any serial data.

+5V-DN, +5V-A, +5V-B – These are power monitoring LEDs used to confirm that regulators for isolated power supplies are energized for the DeviceNet transceiver, the serial ports, and for the discrete inputs, respectively.

Analog mA Transmitter LEDS – LEDs 1, 2, 3

correspond to the mA transmitters on terminals 37-38, 39-40, and 41-42. If a transmitter is powered, its LED will always be either RED or GREEN.

GREEN indicates that the transmitter output matches its digital data command. Even if the output is unconnected, the LED may remain green if it is attempting to transmit 0.0 mA.

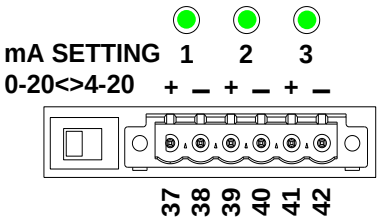


Figure 19 mA Transmitter Terminals.

RED indicates that the transmitter output does not match its digital data command because the load resistance is so high that it has reached its highest compliance voltage before reaching the desired current. (This will normally happen if the user does not attach the output to a mA receiver or resistor.) A transmitter is capable of a maximum 15V signal into a 750-ohm load when transmitting the maximum 20 mA signal. See the analog output section for a more detailed description.

See DeviceNet Communication for a description of the DeviceNet Status LEDs.

2.19 Signal Isolation

Full Galvanic Isolation for Power Lines – The MP1 Controller uses voltage potential transformers and current transformers to measure SCR voltages and currents. Control power is derived using transformer isolated switching power supplies. Full isolation from all power lines provides the best noise immunity and safety in an industrial environment.

The DeviceNet transceiver is powered by the network cable and is isolated from all other circuits. This provides the highest isolation for the DeviceNet cabling and minimizes the power requirements from the DeviceNet cable power supply.

Power for the optional HMI panel, serial ports, discrete input terminals, external 15 V dc supply, and 4-20 mA transmitters share common power that is isolated from all other circuits.

The analog command signal input and analog feedback input are powered by another isolated power supply. This provides a high level of protection to prevent an analog command loop from being corrupted by noise from mA transmitters, digital communication, and discrete relays. It also allows the analog command common to be connected to a point other than the power supply ground. This may be required with some temperature controllers.

2.20 Local Serial Communication Ports – Modbus™ RTU Only

The MP1 Controller is primarily a DeviceNet product. The local serial ports using

Modbus functions are primarily intended for connection to HDR HMI panels. Complete hardware and communication information is provided to assist users in custom applications. The user is responsible for testing and confirming the suitability of the MP1 Controller's communication with their application.

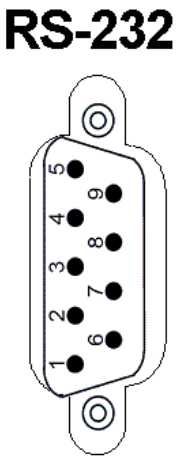
The MP1 Controller has two local serial ports: one RS-232 type, and one RS-485 type. Both support Modbus command functions to provide for easy customization using standard HMI control panels, or Modbus computer communication. The RS-232 port is most suitable for independent zone mini-HMI panels or direct connection to a standard computer port. The RS-485 port allows multiple connections on one bus allowing one Modbus master to access many units. One possible use for RS-485 is to support a larger local HMI panel that offers summary display of all zones in a multi-zone system. RS-485 is also more suitable for a single HMI connection if the cable distance is more than about 50 feet.

The Modbus parameters and DeviceNet parameters are not mirror images. While many of the controller parameters are the same, the communication is designed for each with planned control arbitration.

The Modbus ports are considered local controls. While they may usually be used for monitoring controller status and metering, they may also be used for manual RUN/STOP control and manual setpoint control. When used for manual control, the local ports have priority over DeviceNet.

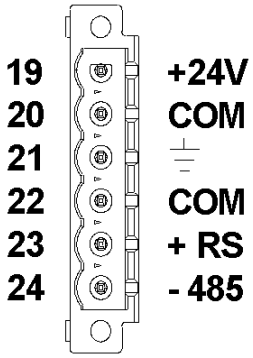
IMPORTANT – The RS-232 and RS-485 ports write to the same Registers in the MP1 Controller. Both may be used simultaneously to monitor values. Both may also write to Registers. If they both write to the same register, the write commands will be serviced in a first-come, first-serve order. If they are simultaneously and repeatedly sending different commands to the same Register, the Register value will alternate between the two values and the affect may be an unplanned change in the controller operation.

Connectors – These diagrams detail the serial port connections.



RS-232 Connector – DB-9 Male DTE
Pin 1 = NC
Pin 2 = Rx
Pin 3 = Tx
Pin 4 = NC
Pin 5 = COM
Pin 6 = NC
Pin 7 = Connects to Pin 8*
Pin 8 = Connects to Pin 7*
Pin 9 = NC
Shell and Screws are grounded to Chassis
*Pins 7-8 are tied together to connect (RTS) Request To Send and (CTS) Clear To Send to accommodate the HDR mini-HMI panel. The MP1 SCR DeviceNet Head does not support active handshaking.

Figure 20 RS-232 Connector



RS-485 Connector – 6-Pin Open Connector
Term 19 = +24 V dc
Term 20 = COM
Term 21 = Chassis Ground
Term 22 = COM
Term 23 = + RS-485 (D1)
Term 24 = - RS-485 (D0)

Figure 21 RS-485 Terminals

COM Common I/O reference - Numerous I/O connections share a common reference labeled COM. This includes: RS-232 pin 5, RS-485 Terminals 20, 22., discrete input terminals 27, 30, 33, 36, and the (-) terminal of each 0-20 mA transmitter. This common COM connection is isolated from DeviceNet, the analog inputs, and the internal circuits.

This COM common is referenced to chassis ground with 1 Meg Ohm in parallel with 0.01uF. A user may make a lower impedance connection to earth ground at one point in the system. Any connection to distant point, such as a distant RS-485 point increases the possibility of unexpected ground currents in the common connection

The two ports have the following configurable characteristics.

RS-232
Baud Rates: 19200(default), 9600, 4800, and 2400.
Data: 8 Bits with 1 Start Bit.
Stop Bit/Parity: 1 Stop + Even Parity (default), 1 Stop + Odd Parity, 2 Stop + no Parity.
Modbus Address: 1-247 (1 = default).
Physical: DB-9 Male

RS-485
Baud Rates: 19200(default), 9600, 4800, and 2400.
Data: 8 Bits with 1 Start Bit.
Stop Bit/Parity: 1 Stop + Even Parity (default), 1 Stop + Odd Parity, 2 Stop + no Parity.
Modbus Address: 1-247 (1 = default).
Physical: 6-pin Male Header including 24 V dc power for an external mini-HMI panel.
Input Impedance: 96-kohm allowing up to 247 devices on buss.
Line Polarization: The receiver does not provide or need line polarization resistors (pull-up or pull-down) when the connector is left open (no active transmitter).

RS-485 Wiring - An RS485-MODBUS must use a balanced pair and a third wire (for the Common). A MODBUS over Serial Line Cable must be shielded. At one end of each cable its shield must be connected to protective ground. If a connector is used at this end, the shell of the connector is connected to the shield of the cable.

A multidrop RS-485 bus may need pull-up and pull-down resistors located at the master, and line termination resistors. Guidelines for the design of RS-485 bus layout and design are beyond the scope of this document. The user is refereed to www.modbus.org.

Details of the reachable registers are detailed in our communication section later in the manual.

WARNING – RS-485 - It is of great importance to ensure at the time of the procedure of devices addressing, that there are not two devices with the same address. In such a case, an abnormal behavior of the whole serial bus can occur, the Modbus Master being then in unable to communicate with all present slaves on the bus.

Modbus RTU is the only supported communication protocol. Correct RTU timing is required. The unit will not repair Modbus RTU packets with defective timing.

Modbus Functions – The following Modbus functions are supported.

Coil Functions (Access to Address Range 000001 to 000064)
01 (0x01) Read Coils (Read from 1 to 64 coils*)
05 (0x05) Write Single Coil
15 (0x0F) Write Multiple Coils (Write from 1 to 64 Coils*)
* 64 are the maximum number of Coils in the MP1 Controller

Register Functions (Access to Address Range 400001 to 400264 [subject to change])
03 (0x03) Read Holding Registers (Read from 1 to 125 Registers**)
06 (0x06) Write Single Register
16 (0x10) Write Multiple registers (Write from 1 to 120 Registers**)
** Register values shown are the maximum number supported by the Modbus function for a single instance of a read or write command.

The ability to access multiple values with a single command is supported fully per Modbus specification to allow the most efficient communication from the Modbus master.

The unit also accepts Modbus Broadcast messages. These are addressed to address "0" and are received and processed by all units. No replies are sent from a slave with broadcast messages, so they only apply to write functions.

Modbus Memory Model – The 64 Modbus Coil bits overlay the first four 16-bit Registers. Therefore, you may access these first 64 bits using either Coil Functions or Register Functions. The availability of the Coil functions is to support HMI panels, or software, that may have may not easily support access to individual bits in Registers.

By definition, Modbus Coils and Registers are read/write addresses. MP1 Controller parameters designated as read-only (Get only) will ignore write data.

For more information about the Modbus protocol, please visit www.modbus.org .
See:
MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1a
MODBUS over Serial Line Specification & Implementation guide V1.0

2.21 DeviceNet™ Communication

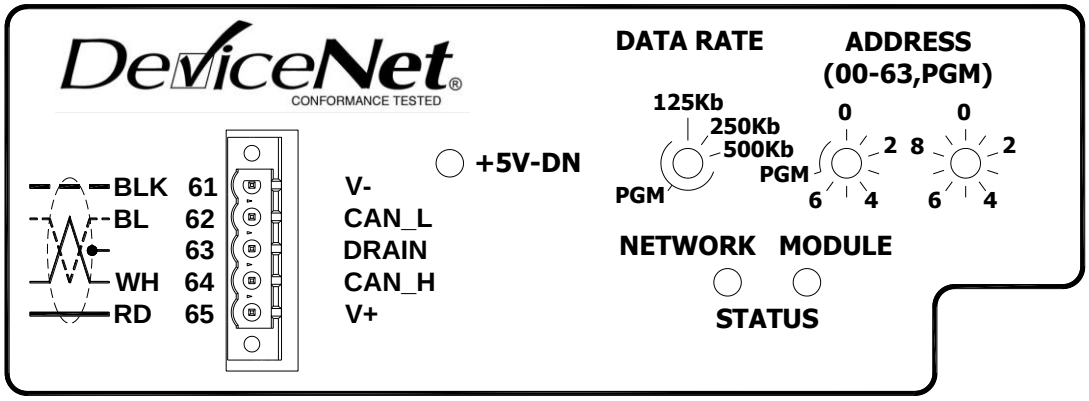


Figure 22 DeviceNet Section, Front Panel.

The MP1 Controller is very flexible. While capable of running with no digital communication, it is also designed to be entirely controlled via DeviceNet. This allows a user to start using the unit without a functional network. Initially, a network may be used only for monitoring and later expand to greater control. More importantly, it allows the unit to fall back to non-network operation during network failures. This allows manual operation of the furnace to continue. For manual operation, the HDR mini-HMI panel is highly recommended over discrete analog meters, switches, and potentiometer. The unit is also designed to support only legacy discrete controls when needed.

The MP1 Controller supports the following DeviceNet functionality:

- Baud Rates: 125K, 250K, 500K
- Polled I/O slave messaging
- Explicit Messaging
- UCMM (Unconnected Message Manager)
- BAUD and MAC ID rotary switch settings including programmable positions.
- Offline Connection Set Messaging supported when using programmable MAC ID settings.
- EDS, Electronic Data Sheet

NODE ADDRESS and BAUD SWITCHES - The node Baud Rate and Address switches on the front of the MP1 SCR DeviceNet Head provide a physical means of setting and confirming the device Baud Rate and Address configuration before connection to the network. Address switch settings above 63 allow a node address to be software configured over the network. Baud switch settings above 2 allow a Baud Rate to be configured over the network. Offline Connection Set Messages are supported when switches are set for software configuration.

NETWORK STATUS LED – This RED/GREEN LED indicates the status of the communication link.

The following table defines the Network Status LED states. The MP1 Controller is a UCMM capable device.

For this state:	LED is:	To indicate:
Not Powered/Not On–line	Off	Device is not on–line. - The device has not completed the Dup_MAC_ID test yet. - The device may not be powered, look at Module Status LED.
On–line, Not Connected	Flashing Green	Device is on–line but has no connections in the established state. - The device has passed the Dup_MAC_ID test, is on–line, but has no established connections to other nodes. - For a UCMM capable device it means that the device has no established connections.
Link OK On–line, Connected	Green	The device is on–line and has connections in the established state. - For a UCMM capable device it means that the device has one or more established connections.
Connection Time–Out	Flashing Red	One or more I/O Connections are in the Timed–Out state.
Critical Link Failure	Red	Failed communication device. The device has detected an error that has rendered it incapable of communicating on the network (Duplicate MAC ID, or Bus–off).
Communication Faulted and Received an Identify Comm Fault Request - Long Protocol	Flashing Red & Green	A specific Communication Faulted device. The device has detected a Network Access error and is in the Communication Faulted state. The device has subsequently received and accepted an Identify Communication Faulted Request - Long Protocol message.

From "THE CIP NETWORKS LIBRARY, Volume 3, DeviceNet Adaptation of CIP, Edition 1.1, January 2005" ODVA.

MODULE STATUS LED - This RED/GREEN LED provides device status. It indicates whether or not the device has power and is operating properly.

The following table defines the Network Status LED states.

For this state:	LED is:	To indicate:
No Power	Off	There is no power applied to the device.
Device Operational	Green	The device is operating in a normal condition.
Device in Standby (The Device Needs Commissioning)	Flashing Green	The device needs commissioning due to configuration missing, incomplete or incorrect. The Device may be in the Standby state. Reference the Identity Object in Volume 1, CIP Common, Chapter 5: Object Library.
Minor Fault	Flashing Red	Recoverable Fault
Unrecoverable Fault	Red	The device has an unrecoverable fault; may need replacing.
Device Self Testing	Flashing Red–Green	The Device is in Self Test. Reference the Identity Object in Volume II for Device states.

From "THE CIP NETWORKS LIBRARY, Volume 3, DeviceNet Adaptation of CIP, Edition 1.1, January 2005" ODVA.

Advisory – The MP1 SCR DeviceNet Head (Rev 1.001) Module Status LED will also turn red when the Network Status LED turns red due to a Bus-off condition. As such, it is an overly conservative indicator of events. It does not indicate the unit may need replacing.

2.22 Flash Memory

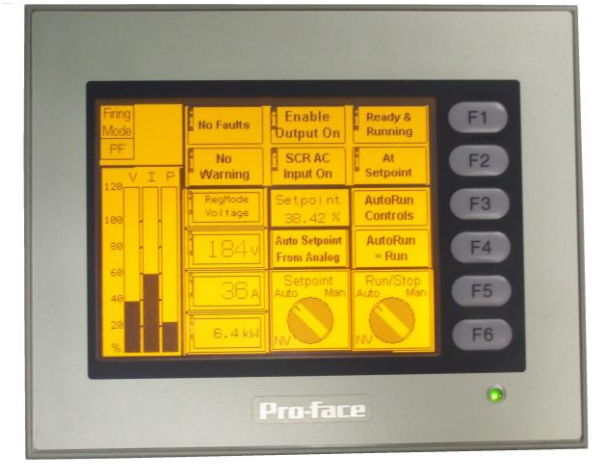
The MP1 Controller incorporates FLASH program memory.

2.23 FRAM – Ferroelectric Nonvolatile RAM

Configuration parameters, calibration parameters, event log, and other non-volatile information are stored in FRAM memory. Replacing traditional serial EEPROM, FRAM provides unlimited read/write cycles, 45-year data retention, and no write delays. These memory features allow the MP1 Controller greater nonvolatile event logging capability and other features that rely upon nonvolatile memory.

2.24 Optional Accessory: HDR HMI Touch Control Panel (Preliminary)

In sharp contrast to the minimal and cryptic control panels often connected to some controllers, the local serial ports combined with new inexpensive HMI control panels can provide easy and convenient access to all controller parameters.



Most system applications require a mix of meters and lamps for monitoring controller operation along with switches and a potentiometer to manually control an SCR controller. These manual controls are often essential during furnace commissioning or during maintenance when network controls are off or the temperature controller command loop is not functional.

HDR's HMI control panel may be used to replace multiple meters, switches, lamps, and potentiometer.

The HMI allows access to all metering, alarm, and status information. Additionally, it provides access to any configuration and calibration parameters. Alarm configuration and settings may be conveniently changed.

If a controller is being replaced, the HMI may also be used to copy/store all configuration values from the original controller (using the HMI's own nonvolatile memory), and then copy the same values back to a replacement controller.

Consult the factory for the latest information and feature of the mini-HMI panel.

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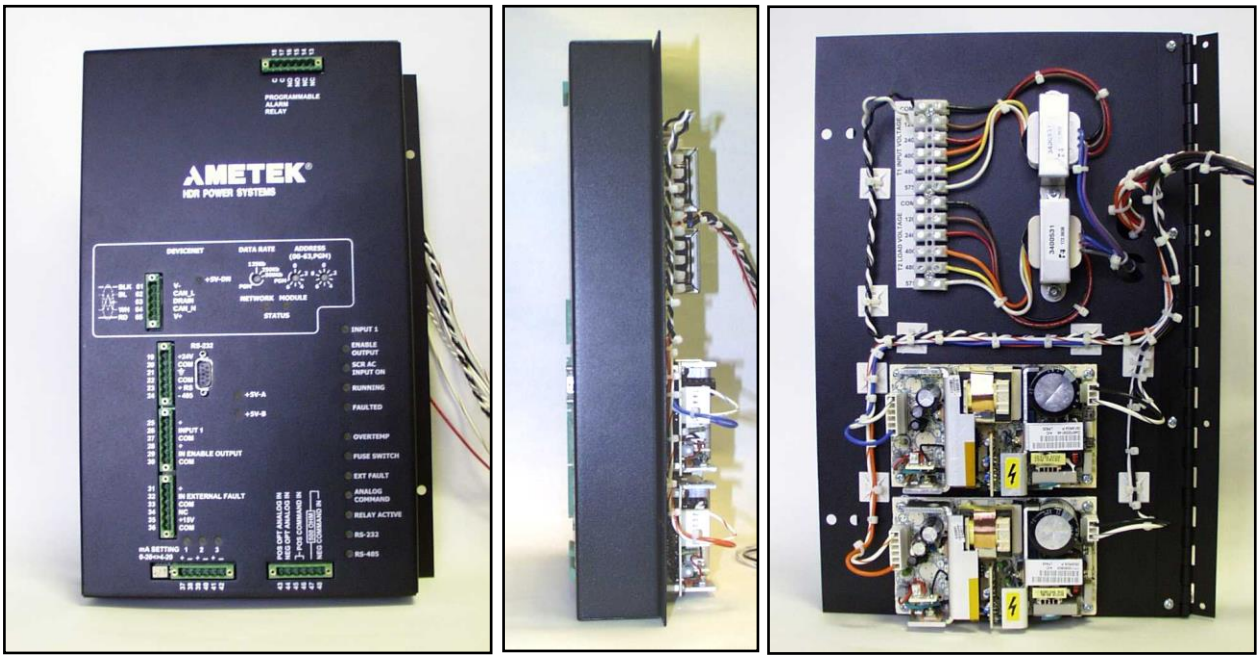
3 INSTALLATION

3.1 MP1 SCR DeviceNet Head Assembly

The MP1 SCR DeviceNet Head is a compact assembly that may be mounted in various ways. On smaller SCR controllers, the head serves as the front door of a complete SCR controller.

Consult the factory for various mounting methods if you are adapting this to your own assembly.

Figure 23 Photos of the MP1 SCR DeviceNet Head (front, side, rear)



3.2 MP1 SCR DeviceNet Head Wiring

Refer to APPENDIX D SCHEMATIC. This show the internal wiring and input/output wiring of a complete controller using the MP1 SCR DeviceNet Head.

If you purchased the MP1 SCR DeviceNet Head as a separate item to assemble a complete controller, you must supply the additional components shown and make the following internal connection.

CAUTION: The primary side of the isolation transformer connects to the high voltage supplying the SCRs. Verify that all utility voltage to the controller is disconnected before attempting any wiring changes within the controller or between the MP1 SCR DeviceNet Head and the SCR mechanical assembly.

1) 120V AC 50/60Hz logic power must be connected to the supplied 24 V dc power supplies. This will be prewired with one or two pairs of BLK+W/BLK wiring. The input terminal may be shared with user supplied fans.
2) The L1-L2 input voltage to the SCR pair and load must be connected to the primary of "T1 Input Voltage" transformer.
   a) Adjust the voltage taps used to match the nominal input line voltage. Refer to the section titles "Inputs: SCR Voltage and Current Measurement" for voltages not listed on the terminal label.
   b) ESSENTIAL – Connect the AC polarity as shown with the lower tap (COM) to the L1 line connected to the SCRs. This is used to synchronize the SCR gate firing in addition to measuring the voltage and frequency of the input.
3) Optionally, if your assembly provides a FUSE OPEN switch and/or HEATSINK thermostat, connect these as shown.
4) ESSENTIAL – Connect the two pairs of SCR gate/cathode wires to the SCRs as shown. The SCR connections must be as shown to synchronize the SCR gate firing.
5) Connect one CT (current transformer) to the terminals shown.
6) "T2 Load Voltage" must be connected to the load. The standard connection would be to the X1-L2 load voltage at the output of the SCR assembly. Optionally, you may connect this to the secondary of any load transformer. Such remote connection must be fused per local code.
7) Optionally, you may install a second CT on the output of a load transformer. If you wish to operate with only one CT, leave the second CT terminals open.
8) Connect the Green Ground wire to an effective grounding point in the base assembly.
9) The input voltage, output voltage, CT ratios, and number of CTs connected are configuration parameters that must be set to match your physical assembly.

3.3 SCR Controller Installation Wiring

If you purchase a complete SCR controller including the MP1 SCR DeviceNet Head, install the controller according to the installation drawings provided with the unit. Installation drawings will include mechanical mounting dimensions.

The following sections summarize the electrical connections needed for any MP1 Controller. Also, refer to the two schematics in Appendix D of this manual.

Figure 24 Photo of Example SCR controller with the MP1 SCR DeviceNet Head option

3.3.1 SCR Controller Installation Wiring: Qualified Installer Required

CAUTION – Equipment must be installed by a qualified person according to local building codes.

3.3.2 SCR Controller Installation Wiring: L1, L2, X1

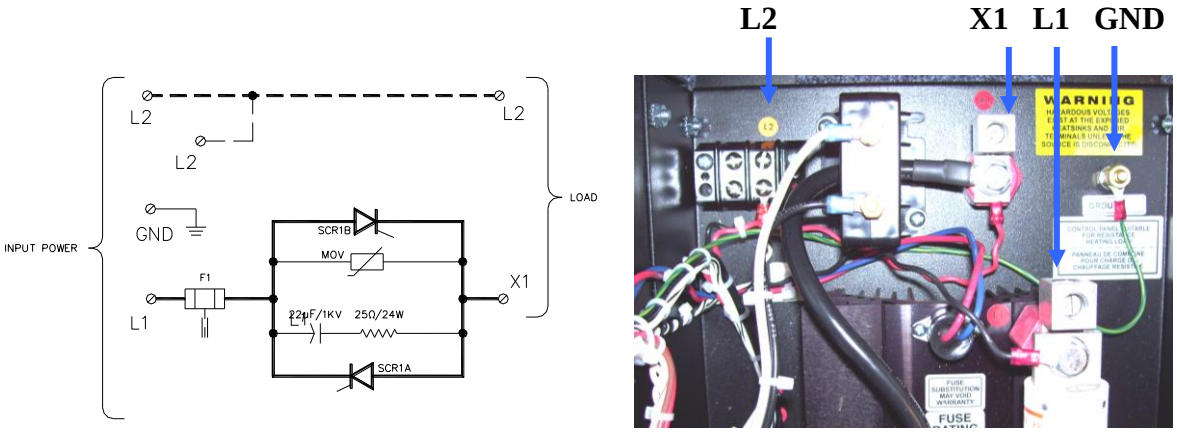


Figure 25 Wiring: L1, L2, X1

The above illustration shows a simplified schematic and example assembly. Terminals L1, L2, and X1 will be labeled.

1. Connect the incoming L1 line to the terminal L1.
2. Connect the incoming L2 line to one end of the load. (The heavy L2 line is not within the controller.)
3. Connect an L2 reference line to the small screw terminal labeled L2.
4. Connect the outgoing X1 line to the other end of the load.

3.3.3 SCR Controller Installation Wiring: Earth Ground

Connect an earth ground connection to the brass screw labeled GROUND. This is required both for safety and for proper operation of communication channels.

3.3.4 SCR Controller Installation Wiring: Terminals 51-52 – Optional Output C.T.

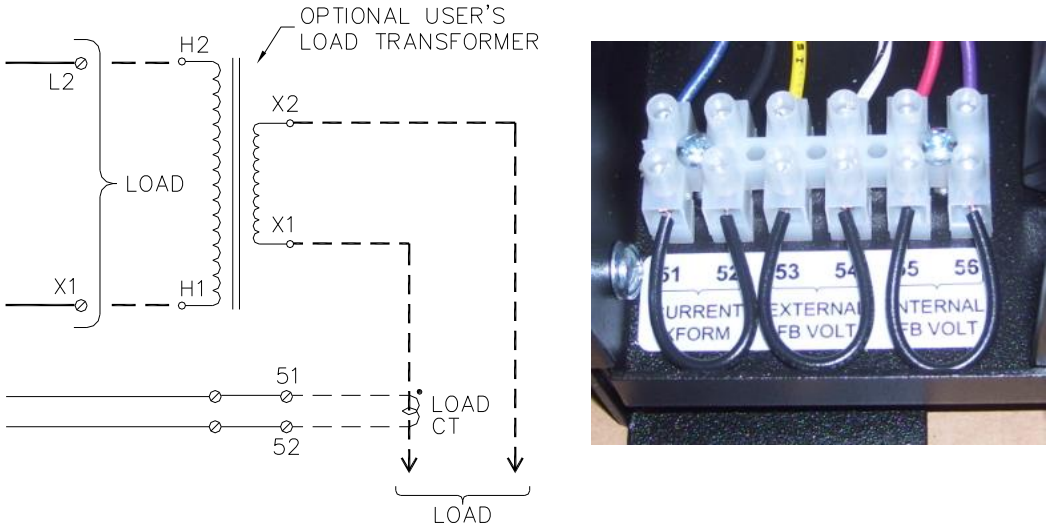


Figure 26 Wiring: Terminals 51-52 – Optional Output C.T.

The default configuration uses one internal current transformer to measure both input and output current.

TIP – Even when one CT is used to measure input and output current, you may change the configuration parameter "*Iout CT Rating*" to scale the output current engineering units differently than the input current. This method simulates the current reading of a second CT on a transformer secondary (ignoring transformer losses). Note - "*Iout CT Rating*" and "*Vout PT Primary*" must both be scaled appropriately for KWout metering to be scaled correctly.

If an application is to use a second current transformer to measure output current, the second CT must connect to TERMINALS 51-52.

Minimum 14 AWG wire is recommended. Heavier wire may be needed for long runs to avoid CT saturation at full load.

If a second CT is connected, the configuration parameter "*Current Transformer Count*" must be changed from 1 to 2. The configuration parameter "*Iout CT Rating*" must be changed to match the primary rating of the second CT.

WARNING

TERMINALS 51-52 may only connect to a 5A AC Current Transformer.
DO NOT CONNECT 51-52 to any other points or voltages.
If a second CT is not used, leave terminals open.

3.3.5 SCR Controller Installation Wiring: Terminals 53-54 & 55-56 – Load Voltage

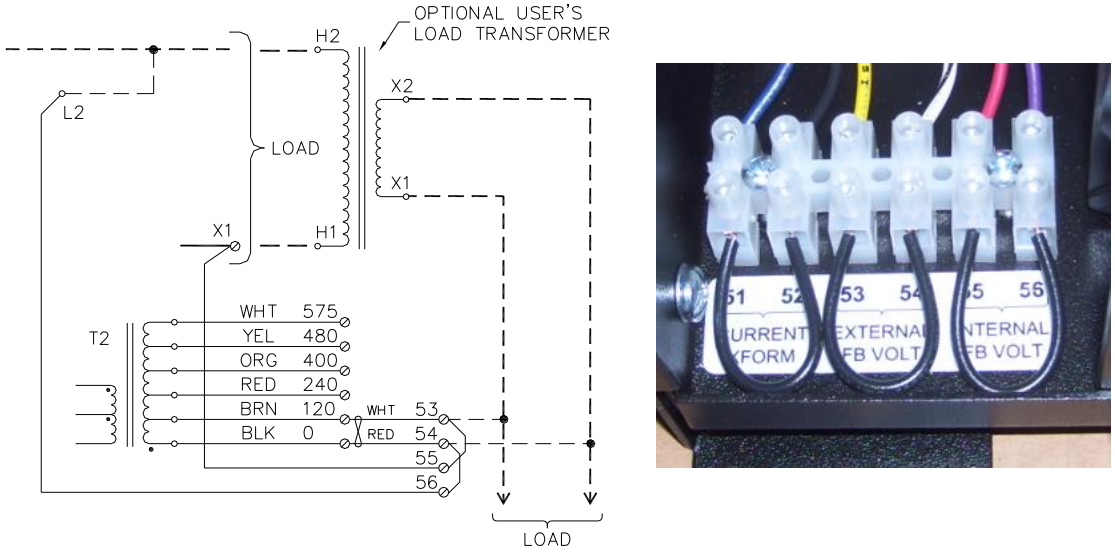


Figure 27 Wiring: Terminals 53-54 & 55-56 – Load Voltage

WARNING

55 = X1

56 = L2

TERMINALS 55-56 are wired internally to the X1, L2 terminals.

These may be jumpered to TERMINALS 53-54 (factory default wiring) to allow TERMINALS 53-54 to sense controller output voltage, ONLY IF TERMINALS 53-54 are not connected to any external voltage.

IF TERMINALS 53-54 are connected to an external feedback voltage (typically the secondary of a load transformer), the jumpers MUST be removed between TERMINALS 53-54 and TERMINALS 55- 56.

- DO NOT CONNECT TERMINALS 55-56 to any other points or voltage.
- DO NOT CONNECT TERMINALS 55-56 to any voltage source including input AC, output AC, or Load.
- DO NOT CONNECT TERMINALS 55-56 to any Current Transformer wiring.

Output voltage is measured using an isolation potential transformer, T2, mounted on the rear of the front door. T2 is wired to TERMINALS 53-54.

The default configuration is to use internal jumpers to connect TERMINALS 53-54 to 55-56 for controller output voltage measurement.

TIP – Even if you use the default internal voltage connection, you may change the configuration parameter "*Vout PT Primary*" to scale the output voltage engineering

units differently than the input voltage. This method simulates the voltage reading of a transformer secondary (ignoring transformer losses). Note - "*Iout CT Rating*" and "*Vout PT Primary*" must both be scaled appropriately for KWout metering to be scaled correctly.

If a user prefers to connect to an external load voltage for voltage measurement/feedback (typically to a transformer secondary), the jumpers MUST be removed and TERMINALS 53-54 must be wired to the external voltage ONLY.

If TERMINALS 53-54 are wired to an external voltage that is different from the input voltage, change configuration parameter "*Vout PT Primary*" to match the nominal measured voltage.

3.3.6 SCR Controller Installation Wiring: Verity/Revise T1 & T2 Transformer Taps

WARNING

Verify Transformer Tap Wiring - Connecting the T1 and T2 isolation voltage transformers to voltages higher than the tap values used will damage the transformers.

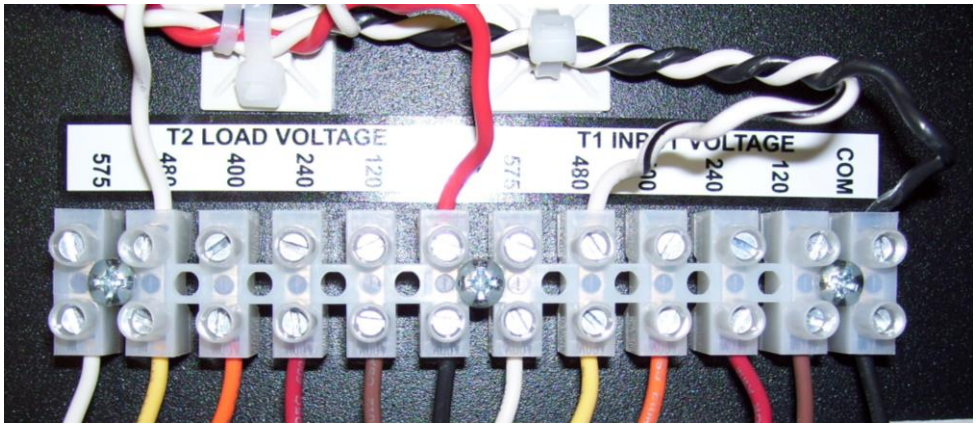
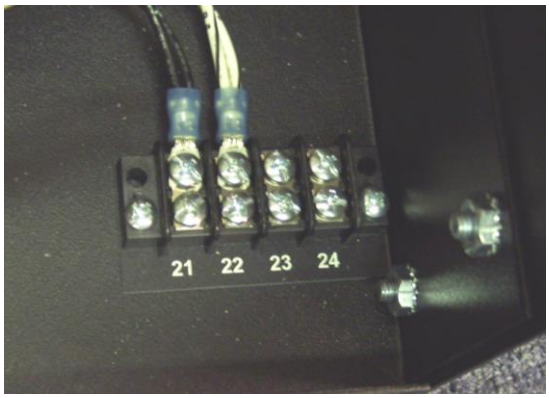


Figure 28 Wiring: Verity/Revise T1 & T2 Transformer Taps

For maximum isolation, the MP1 controller uses isolation transformers to measure input and output AC voltages.

1. INPUT AC – Verify that the voltage taps for T1 INPUT VOLTAGE matches the controller input voltage wired to terminals L1-L2.
2. OUTPUT AC – Verify that the voltage taps for T2 LOAD VOLTAGE matches the voltage wired to TERMINALS 53-54. If TERMINALS 53-54 are jumpered internally, to TERMINALS 55-56, both voltages will be the same. If TERMINALS 53-54 are wired to an external voltage, the T2 tap voltage must match, or be slightly higher than, the nominal measured external voltage.
3. See Section Inputs: SCR Voltage and Current Measurement (Internal) for voltages not explicitly listed.

3.3.7 SCR Controller Installation Wiring: Terminals 21-24

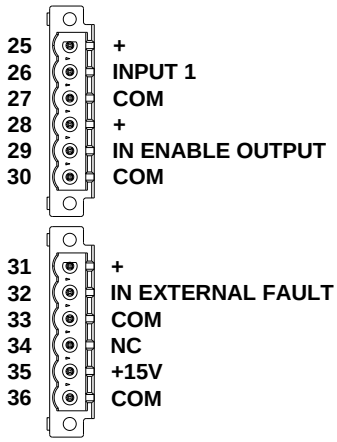


TERMINALS 21-22 primarily provides logic power, even when SCR input power to TERMINALS L1 and L2 is off. A secondary function of TERMINALS 21-22 is to power internal fans (if used).

If there are no fans, you may power TERMINALS 21-22 with 85-264 VAC, 50/60Hz.

If internal fans are used, you must use the voltage rating of the fan. This is typically either 120V or 230V.

3.3.8 SCR Controller Installation Wiring: Front – INPUT1



Note – The logic of the discrete inputs may be inverted by changing a configuration parameter. The descriptions here assume the default configuration.

Figure 29 Wiring: Front – INPUT1, ENABLE OUTPUT, EXTERNAL FAULT

Refer to Figure 29 Wiring: Front – INPUT1, ENABLE OUTPUT, EXTERNAL FAULT above.

INPUT1 is used to support optional features or as a discrete input point for network monitoring. You may leave this disconnected unless application instructions provide more information. See Section INPUT1 Programmable Discrete Input for more information about INPUT1 and its uses.

3.3.9 SCR Controller Installation Wiring: Front – ENABLE OUTPUT

Refer to Figure 29 Wiring: Front – INPUT1, ENABLE OUTPUT, EXTERNAL FAULT above.

ENABLE OUTPUT is used as a local discrete input to enable the SCR output. A contact closure between TERMINALS 28-29 will turn on the LED labeled ENABLE OUTPUT. ENABLE OUTPUT is one item that must be enabled to make the controller ready to run. Opening ENABLE OUTPUT is one method of resetting a fault trip.

1. If you have a contact to control ENABLE OUTPUT, wire it to TERMINALS 28-29.
2. **IF NOT USED, install a wire jumper between TERMINALS 28-29 to keep this signal true.**

3.3.10 SCR Controller Installation Wiring: Front – EXTERNAL FAULT

Refer to Figure 29 Wiring: Front – INPUT1, ENABLE OUTPUT, EXTERNAL FAULT above.

EXTERNAL FAULT will always make the controller NOT ready to run when closed.

1. **IF NOT USED, leave TERMINALS 31-32 open.**
2. If a mechanical contact is available to disable the unit, wire the contact to TERMINALS 31-32.

3.3.11 SCR Controller Installation Wiring: Front – Three mA Drivers

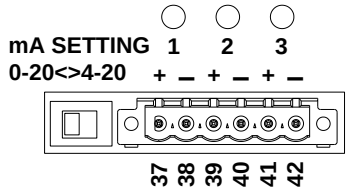


Figure 30 Wiring: Front – Three mA Drivers

Although re-configurable, the default setting for the mA transmitters is to send 0-20 or 4-20 mA signals representing 0-100% voltage, current, and power, respectively.

1. IF USED, connect to an appropriate mA receiver (750 ohms max).
2. If not used, leave open.
3. Set the slide switch to configure the signals for 0-20 mA or 4-20 mA range.

3.3.12 SCR Controller Installation Wiring: Front – Analog In – COMMAND Setpoint

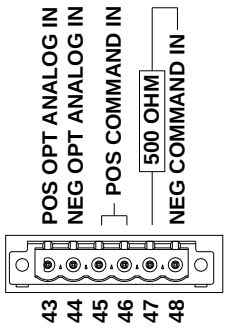


Figure 31 Wiring: Front – Analog In – COMMAND Setpoint

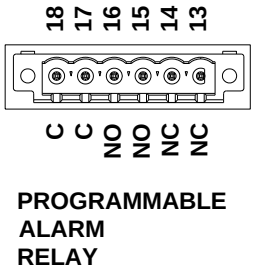
1. If the command input is a mA signal, place a jumper between TERMINALS 46-47 to connect an internal 500 ohm load. Leave open for voltage input (10 V dc max).
2. Connect the (+) wire to TERMINAL 45.
3. Connect the (-) wire to TERMINAL 48.

3.3.13 SCR Controller Installation Wiring: Front – Analog In – OPT ANALOG Feedback

The OPT ANALOG IN terminal is for an optional analog input point that may be used as a control feedback source for custom applications.

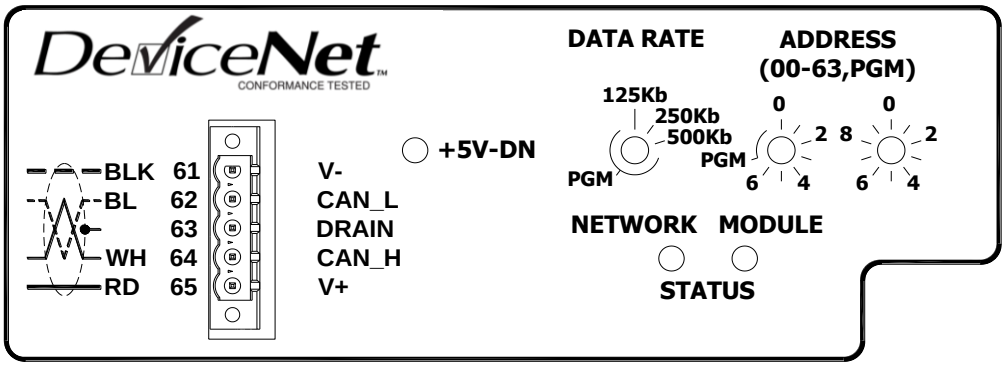
1. IF NOT USED, leave TERMINALS 43-44 open.
2. IF USED, Connect the (+) wire to TERMINAL 43, (-) wire to TERMINAL 44 (10 V dc max).
3. If a mA input is used, connect 500 ohms, ½ watt, externally.

3.3.14 SCR Controller Installation Wiring: Front – Programmable Alarm Relay



One Form C Relay is available. Two screws are available for each contact. Contacts are labeled C, NO, and NC. Wire as needed.

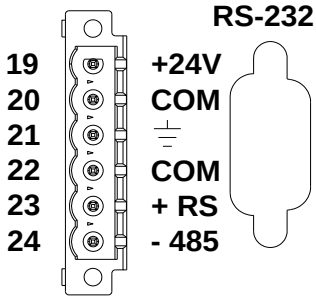
3.3.15 SCR Controller Installation Wiring: DeviceNet



Wire the supplied plug following the color code on the silkscreen. The standard supplied plug supports two cables for easy daisy-chaining of network cabling. This also allows the plug to be unplugged without breaking the network link.

If values are known at time of installation, set the DATA RATE and ADDRESS using the rotary switches.

3.3.16 SCR Controller Installation Wiring: RS-232/RS-485 Communication



If an RS-232 HMI is used. Connect TERMINALS 19, 20, and 21 to connect power and earth ground to the HMI. Connect a null modem cable between the HMI and RS-232 connector.

If an RS-232 computer connection is used, connect the computer serial port to the DB9 connector using a null modem cable.

If an RS-485 HMI is used, connect power and signals using TERMINALS 19-24. Follow any connection drawing supplied with the HMI.

3.4 Rotary Switch Introduction

IMPORTANT

Recommendations:

1. Use the rotary switches to set the MAC ID and Baud Rate prior to starting the unit.
2. Make sure you have the most current configuration information prior to saving an RSNetWorx configuration file.
3. Be aware that the “Restore Device Defaults” button in RSNetWorx will reset the units node address setting to 63, if the MAC ID switch is in the programmable position, and reset the Baud rate to 0, if the BAUD rate switch is in the programmable position.
4. Be aware that the “Restore Device Defaults” button in RSNetWorx will reset all configuration parameters and may cause unintended unit operation.

The MP1 Controller’s MAC ID and Baud Rate are set using front panel switches that include programmable positions. While switch settings or programmable settings may be used, it is good practice to use one method throughout the system. Each network device must have a unique address from 0 to 63. Typically, node address 0 is used by the master device (scanner), and node address 63 is left unused to introduce new slaves.

3.5 Hardware Switch Setting

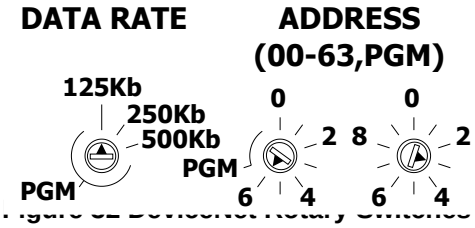


Table 4 Node Address Setting

Switch Settings	Description
0..63	When set in this range, the switch value is loaded into nonvolatile memory when the unit powers up or resets, prior to going online. The unit shall then attempt to go online with the value stored in nonvolatile memory. Network messaging cannot change the address stored in nonvolatile memory when the switch is in this range.
64..99 = PGM (programmable)	When set in this range, the switch value is ignored when the unit power up or resets. The unit shall attempt to go online with the last value stored in nonvolatile memory. Network messaging can change the address stored in nonvolatile memory when the switch is in this range.
63	Factory default switch setting.

Table 5 Node Baud Setting

Switch Settings	Description
0 = 125k 1 = 250k 2 = 500k	When set in this range, the switch value is loaded into nonvolatile memory when the unit powers up or resets, prior to going online. The unit shall then attempt to go online with the value stored in nonvolatile memory. Network messaging cannot change the address stored in nonvolatile memory when the switch is in this range.
3..9 = PGM (programmable)	When set in this range, the switch value is ignored when the unit power up or resets. The unit shall attempt to go online with the last value stored in nonvolatile memory. Network messaging can change the address stored in nonvolatile memory when the switch is in this range.
0 = 125k	Factory default setting

When commissioning the unit:

1. Set the node address and Baud Rate switch values to valid settings (0-63 and 0-2, respectively).
2. Cycle power to the unit to initialize the setting in nonvolatile memory.
3. If you wish to make the values programmable, move the switches to the PGM positions and cycle power. The unit will power up using the values stored in nonvolatile memory and will be programmable via the network.

A modification of the node Address or Baud Rate while the unit is running will not take effect until the device is either physically reset (such as cycle of power or a reset switch) or reset by sending the Reset Service to the Identity Object. During this time the attribute values will not match the actual network operating values.

IMPORTANT

Resetting the unit to factory defaults, or sending a Reset to the Identity Object with a data value of "1" while the switches are in the PGM position will change the node Address and/or Baud Rate to the default values.

The network has the ability to monitor the values of the switches and the values stored in nonvolatile memory using Parameter 65, MAC ID Switch; Parameter 66, Baud Switch; Parameter 67, NV Dnet MAC ID; and Parameter 68, NV Dnet Baud. By reading the switch values, a master can determine if the values can be modified before attempting to do so.

The parameters 65, 66, 67, and 68 listed above may also be monitored using the local Modbus serial ports. The local Modbus serial ports DO NOT have the ability to change the values of the DeviceNet node Address or Baud Rate. These values cannot be configured using the local Modbus ports.

The DeviceNet Identity Object also supports Attributes 6 MAC ID Switch Changed, 7 Baud Rate Switch Changed, 8 MAC ID Switch Value, and 9 Baud Rate Switch Value.

This unit does not automatically reset the Identity Object whenever the rotary switches are changed.

3.6 Using RSNetWorx™ for DeviceNet

Follow instructions provided with RSNetWorx.

3.7 Registering the EDS File

Follow instructions provided with RSNetWorx.

3.8 Using the Node Commissioning Tool of RSNetWorx for DeviceNet

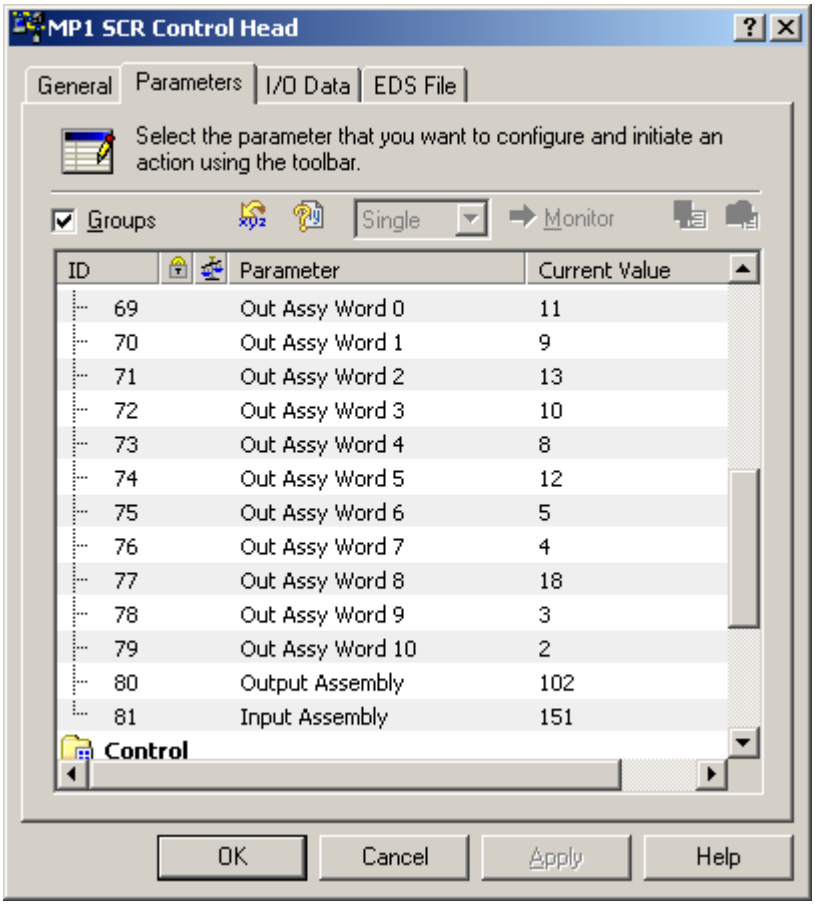
Follow instructions provided with RSNetWorx.

3.9 Input (Produced) and Output (Consumed) Assembly Configuration

Note: “Input” is from the perspective of the master and is the data produced by the slave. “Output” is from the perspective of the master and is the data consumed by the slave.

The power-up/reset Input (produced) Assembly format for the MP1 Controller is identified by the value in Parameter 81, *Input Assembly*. The power-up/reset Output (consumed) Assembly format for the MP1 Controller is identified by the value in Parameter 80, *Output Assembly*. These values determine the size and content of the information traded with the master scanner. Changes to these parameters only take affect on power-up/reset, or a reset to the Identity Object (with data = 1).

Figure 33 I/O Assembly Settings



Configuration of the Input (produced) and Output (consumed) Assemblies define the format of I/O messages exchanged with other devices on the network.

The consumed information is generally used to control the state of the units outputs. Since the MP1 Controller can operate from local discrete and analog command

signals, this may not apply if the network is only used to monitor the unit. Several Output Assemblies are available. The simplest only provides a reset parameter. The largest allows the unit to control RUN/STOP, change the regulation mode, provide the setpoint for the regulation loop, and provide data for analog output points.

The produced information typically contains the state of the slave's inputs and fault status. The MP1 Controller provides several input assemblies. The smallest input assembly contains only the *Faulted* and *Warning* attributes. The largest assembly contains sixteen Boolean flags plus eleven programmable parameter values.

The variety of instances/sizes/formats allows for programming flexibility and network optimization. For details of available I/O assemblies, see the section titled "Assembly Object – Class Code 0x04".

Choosing the size and format of the I/O assemblies is done by selecting the Input and Output Assembly instance numbers. Each assembly has a defined size in bytes. The following tables show only the default assemblies as examples.

Table 6 Default Output Assembly Object Instance 102, 0x66, Data Format

(Identical to Basic Overload Output Assembly 2 from ODVA Overload Profile)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						FaultRst		

Table 7 Default Input Assembly Object Instance 152, 0x98 Data Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Setpoint	RefFrom Net	CtrlFrom Net	Ready	SCR AC In Status	Running1	Warning	Faulted
1	INPUT1 Discrete	Summary Limiting	Max Duty Cycle	Output Enable	Relay State	RefFrom Analog	RefFrom Local	CtrlFrom Local
2	*Value of parameter pointed to by AssyWord0 Param (Low Byte)							
3	*Value of parameter pointed to by AssyWord0 Param (High Byte)							
4	*Value of parameter pointed to by AssyWord1 Param (Low Byte)							
5	*Value of parameter pointed to by AssyWord1 Param (High Byte)							
6	*Value of parameter pointed to by AssyWord2 Param (Low Byte)							
7	*Value of parameter pointed to by AssyWord2 Param (High Byte)							

* BOOL and USINT parameters are filled with leading zeros to fit two bytes. UDINT parameters have no defined result, but are all available as split UINT parameters.

IMPORTANT

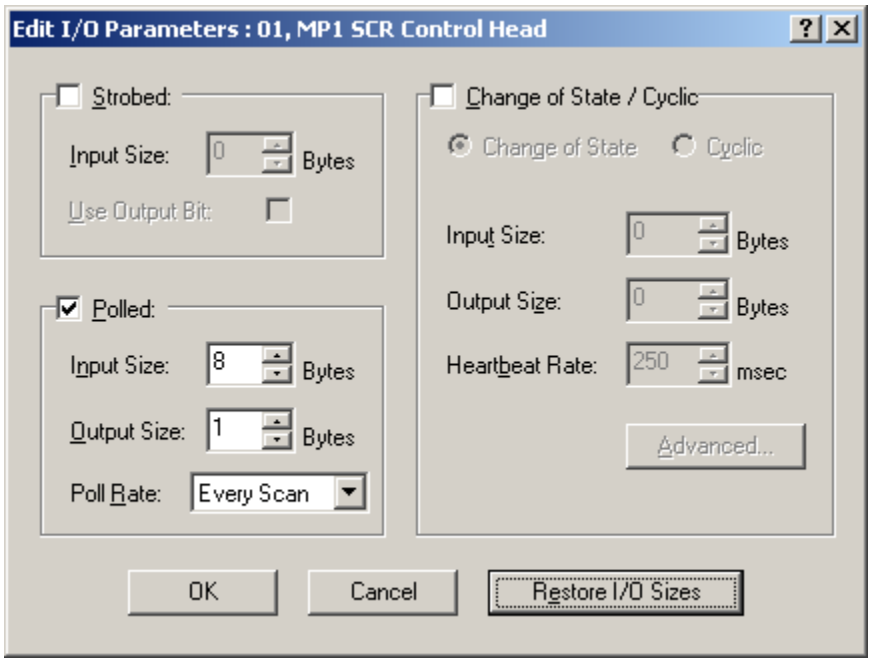
1. Assemblies may be configured via the Modbus local serial ports.
2. Changes to Parameter 81, *Input Assembly*, and Parameter 80, *Output Assembly*, only take affect on power up reset (not while online), or a reset to the DeviceNet Identity Object with data = 1.
3. Changes to the pointer Parameters 69-79, *AssyWord0 Param to AssyWord10 Param*, used to configure input assembly data, takes affect immediately (reset not required).
4. Any changes must be coordinated with the scanner's mapping of the Input Size and Output Size of the Polled I/O connection.

3.10 Mapping the Scanner's Scan List

Many scanners will automatically auto-map the I/O assembly size information. If the default I/O assemblies are not used, the values must be revised in the scanner's scan list.

Do this by selection "Edit I/O Parameters" on the Scan List tab of the scanner.

Figure 34 Editing Scanner Device I/O Parameters



3.11 Commissioning the MP1 SCR DeviceNet Head

Although alternative tools/methods may be provided to program configuration parameters via the local Modbus serial ports, RSNetWorx is the primary tool supported for DeviceNet networks. The product should now be communicating on the network. Before applying power to the SCRs power assembly, all configuration parameters must be configured/confirmed.

Go online using RSNetWorx and open the MP1 SCR DeviceNet Head. Upload all device parameters. You may view parameters sequentially, or by Group. If any value is revised, select single download to transfer the new value to the slave.

The next section in the manual titled “Configuration Parameters” lists all values that must be configured/confirmed. See Appendix A for a configuration checklist.

Figure 35 RSNetWorx Parameter Screen by Parameter Number

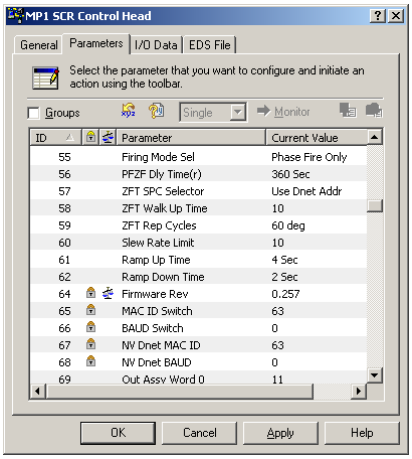
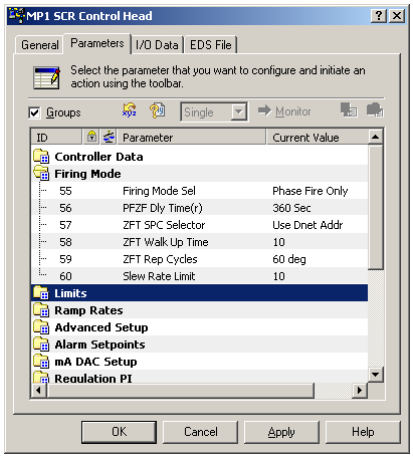


Figure 36 RSNetWorx Parameter Screen by Group



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4 CONFIGURATION PARAMETERS

4.1 Introduction

The MP1 Controller can be configured for custom applications using nonvolatile configuration parameters. This section lists the configuration parameters by group with comments.

There are seventy-five configuration parameters. Most users will only need to change a select subset depending upon the exact application. Unused features may not need configuration. Many may already have default values that do not need to be changed.

4.2 SCR (mechanical/electrical) Assembly Data

There are five configuration parameters in this group. All should be configured in every application to describe the mechanical/electrical attributes of the SCR controller assembly.

The unit is fully transformer isolated for line voltage and current measurements. The voltage and current transformers can have a variety of primary ratings while the secondary is normalized at 100%.

Internally, all setpoint and feedback measurements are handled on a scale of 0-10000, representing 0-100.00%. For informational/display purposes, and to run the kWh meter, it is necessary to know the actual line voltage and current ratings.

One additional parameter is used to specify if the SCR assembly uses one, or two, current transformers. The current in and out of the SCR is the same, so only one is required. If only one is used, the output current measurements will be based on data from a single C.T. It is also possible to install a second C.T. for output current measurements. Some may prefer this for greater accuracy when an output transformer is used and the second C.T. is located on the secondary.

Table 8 SCR Assembly Data Configuration Parameters

(Parameter number, name, and description)

46	*Vin PT Primary*	The nominal (100%) SCR AC input line voltage.
47	*Vout PT Primary*	The nominal (100%) SCR output line voltage.
48	*Current XFMR Cnt*	Number of C.T. used (1 or 2).
49	*Iin XFMR Ratng*	Primary rating of input current transformer.
50	*Iout XFMR Ratng*	Primary rating of output current transformer.

4.3 FiringMode Setup

There are six configuration parameters in this group. The number used depends on the firing mode selected.

The firing mode is configurable. Depending upon the firing mode configured using *Firing Mode Sel*, additional parameters may be used.

Table 9 FiringMode Setup Configuration Parameters

55 *Firing Mode Sel*	Selects Firing Mode for SCR timing controls. This must be configured for the desired firing mode.
If Firing Mode Sel = 1, 3, 4, or 5 – then also configure the next parameter.	
60 *Slew Rate Limit*	Slew rate limit of SCR timing in cycles for 100% change.
If Firing Mode Sel = 5 - PFZF timed control - then also configure the next parameter.	
56 *PFZF Dly Time(r)*	PFZF time delay.
If Firing Mode Sel = 2 - ZFT zero fire into transformer control - then also configure the next three parameters.	
57 *ZFT SPD Selector*	Starting Point Delay Source.
58 *ZFT Walk Up Time*	Number of walk up cycles for the first turn-on.
59 *ZFT Rep Cycle%*	Percent firing angle for first positive ZFT firing burst.

4.4 Reg PI Setup

There are twelve configuration parameters in this group. These settings are used for both regulation and output limiting using phase fire control.

Caution: Default values recommended.

Table 10 Reg PI Setup Configuration Parameters

21 *Vout Prop Gain*	Proportional gain, output voltage.
22 *Vout Integ Gain*	Integral gain control, output voltage.
23 *Iout Prop Gain*	Proportional gain, output current.
24 *Iout Integ Gain*	Integral gain control, output current.
25 *KWout Prop Gain*	Proportional gain, output power.
26 *KWout Integ Gain*	Integral gain control, output power.
27 *Resist Prop Gain*	Proportional gain, resistance regulation.
28 *Resist Int Gain*	Integral gain control, resistance regulation.
29 *ExtFB Prop Gain*	Proportional gain, external analog feedback.
30 *ExtFB Integ Gain*	Integral gain control, external analog feedback.
31 *Iin Prop Gain*	Proportional gain, input current.
32 *Iin Integ Gain*	Integral gain control, input current.

4.5 Limits Setup

There are four configuration parameters in this group. These settings are used for regulation limiting using phase fire control.

Note: Each may be disabled if the value is zero.

Table 11 Limits Setup Configuration Parameters

51	*Iin RMS% Limit*	Iin RMS% regulation limit.
52	*Vout RMS% Limit*	Vout RMS% regulation limit.
53	*Iout RMS% Limit*	Iout RMS% regulation limit.
54	*KW Output% Limit*	KW Output% regulation limit.

4.6 Alarm Setup

There are eleven configuration parameters in this group.

These are alarm trigger setpoints.

Table 12 Alarm Setup Configuration Parameters

33	*Vin High%*	Alarm if Vin Actual RMS% > *Vin High%.*
34	*Vin Low%*	Alarm if Vin Actual RMS% < *Vin Low%.*
35	*Iin PeakFault%*	Input Current Peak%.
36	*Iin Peak Retry*	Input Current Peak Retry count.
37	*Iin Peak Timer*	Input Current Peak Timer limit.
38	*Iin RMS OL%*	Input RMS Current OL% limit.
39	*Iin RMS OL Timer*	Input RMS Current OL% time.
40	*Res Ratio High*	Alarm if Resistance Ratio > *Res Ratio High.*
41	*Res Ratio Low*	Alarm if Resistance Ratio < *Res Ratio Low.*
42	*Freq Deviation*	Alarm if |Frequency Actual – Nominal Input Freq| > *Freq Deviation.*
43	*Ambient OT Limit*	Alarm if Ambient Temp C > *Ambient OT Limit.*

4.7 Advanced Setup

There are eight configuration parameters in this group.

All must be considered during configuration. These affect warning/fault/relay action, discrete signal logic, DeviceNet failure action (if DeviceNet used), and startup options.

Table 13 Advanced Setup Configuration Parameters

137	*Warning Mask*	Bitmask selecting which alarms may trigger a warning.
138	*Fault Mask*	Bitmask selecting which alarms may trigger a fault.
139	*Relay Mask*	Bitmask selecting which alarms may trigger the relay.
140	*Invert Discretes*	Bitmask that may invert any discrete input or the relay output.
141	*NetFaultMode*	Selects DeviceNet NetFault action.
142	*NetIdleMode*	Selects DeviceNet NetIdle action.
195	*AutoRun*	Selects whether the unit runs or stops with only internal control.
196	*Auto RegMode NV*	Selects the regulation mode used at power-up.

4.8 mA DAC Setup

There are six configuration parameters in this group. These must be configured if the mA transmitters are used.

These values select the data source for each of the three mA transmitters and full-scale setting to determine the nominal current at 100%.

Table 14 mA DAC Setup Configuration Parameters

117	*DAC Out1 FS*	Specifies the 100% level for the 16-bit DAC for transmitter 1.
118	*DAC Out2 FS*	Specifies the 100% level for the 16-bit DAC for transmitter 1.
119	*DAC Out3 FS*	Specifies the 100% level for the 16-bit DAC for transmitter 1.
120	*DAC Out1 Select*	Selects the data source for mA transmitter 1.
121	*DAC Out2 Select*	Selects the data source for mA transmitter 2.
122	*DAC Out3 Select*	Selects the data source for mA transmitter 3.

4.9 Ramp Rates Setup

There are two configuration parameters in this group. These should always be configured. They dampen the rate of change of any setpoint control change.

Table 15 Ramp Rates Setup Configuration Parameters

61	*Ramp Up Time*	Rising rate of change limiter applied to the incoming setpoint.
62	*Ramp Down Time*	Falling rate of change limiter applied to the incoming setpoint.

4.10 Event Log

There is one configuration parameters in this group. Use the default value unless you wish to see diagnostic logging for DeviceNet.

Table 16 Event Log Configuration Parameters

82 Log Config	Selects controller events only, or adds DeviceNet network events.

4.11 A/B Serial Ports

There are six configuration parameters in this group. These are critical settings if you intend to use the front panel RS-232 or RS-485 ports. These set the serial port communication parameters.

HINT – If these are changed from the default setting, it may be useful to label the change on the front of the unit.

Table 17 A/B Serial Ports Configuration Parameters

99	*Modbus A Addr*	RS-232: Selects Modbus address.
100	*ABaud Rate*	RS-232: Selects Baud Rate.
101	*AParity/StopBits*	RS-232: Selects Parity/Stop Bit combination.
102	*Modbus B Addr*	RS-485: Selects Modbus address.
103	*BBaud Rate*	RS-485: Selects Baud Rate.
104	*BParity/StopBits*	RS-485: Selects Parity/Stop Bit combination.

4.12 DeviceNet Setup

There are thirteen configuration parameters in this group. These must be configured if DeviceNet I/O messages are used. This must be coordinated with the PLC/scanner programming.

The DeviceNet I/O Assemblies are provided in several sizes so that the user may pick a size that offers the most efficient and compact communication. The unit has a large number of values that a user may wish to monitor. This interface provides a convenient method to select the I/O assemblies are to be used as the start-up default, and which parameter values are to be placed into the programmable input assemblies. Parameters from the Metering Group and Monitor Parameters Group may be most useful, but any may be used.

Table 18 DeviceNet Setup Configuration Parameters

69	*AssyWord0 Param*	Parameter number of the value to be placed in Word 0 location.
70	*AssyWord1 Param*	Parameter number of the value to be placed in Word 1 location.
71	*AssyWord2 Param*	Parameter number of the value to be placed in Word 2 location.
72	*AssyWord3 Param*	Parameter number of the value to be placed in Word 3 location.
73	*AssyWord4 Param*	Parameter number of the value to be placed in Word 4 location.
74	*AssyWord5 Param*	Parameter number of the value to be placed in Word 5 location.
75	*AssyWord6 Param*	Parameter number of the value to be placed in Word 6 location.
76	*AssyWord7 Param*	Parameter number of the value to be placed in Word 7 location.
77	*AssyWord8 Param*	Parameter number of the value to be placed in Word 8 location.
78	*AssyWord9 Param*	Parameter number of the value to be placed in Word 9 location.
79	*AssyWord10 Param*	Parameter number of the value to be placed in Word 10 location.
80	*Output Assembly*	Default start-up output assembly.
81	*Input Assembly*	Default start-up input assembly.
223	*Program Lock*	Parameter locking value.

4.13 Configuration Checklist

See Appendix A for a configuration checklist that can be copied and used as a planner for your application. The checklist lists all configuration parameters. While you review the manual and check parameter functions, you may build the desired configuration plan using the checklist.

5 CALIBRATION PARAMETERS AND PROCEDURE

5.1 Introduction

There are sixteen zero/span analog calibration parameters.

A limited amount of calibration is needed to correct for small component variations and custom applications. This is simplified by using standard components when possible. The current transformers must always be standard 5A C.T.s.

The voltage transformer should always be the HDR #3400531. This has primary voltage taps for 120, 240, 400, 480, and 575VAC. When using any tap at its marked voltage, the secondary voltage is approximately 12.25 VAC. If the application nominal voltage ratings match the tap voltages, calibration should be minimal.

The analog setpoint and feedback inputs may require the most calibration to accommodate a variety of inputs (2-10V, 1-5V, 0-10V, 4-20 mA, etc.). This calibration configures the analog input terminal for the desired type of signal.

Each of the analog input and output points have nonvolatile zero and span calibration parameters. While DeviceNet does have access to these, it may be more convenient to calibrate using the local serial ports since local meter measurement and load manipulation is usually needed.

Table 19 Calibration Configuration Parameters

(Parameter number, name, and description)

198	*Vin CAL ZERO*	Input voltage zero.
199	*Vin CAL SPAN*	Input voltage span.
201	*Vout CAL ZERO*	Output voltage zero.
202	*Vout CAL SPAN*	Output voltage span.
204	*Iin CAL ZERO*	Input current zero.
205	*Iin CAL SPAN*	Input current span.
207	*Iout CAL ZERO*	Output current zero.
208	*Iout CAL SPAN*	Output current span.
210	*KWout CAL ZERO*	KWout calibration zero.
211	*KWout CAL SPAN*	KWout calibration span
213	*Conduct CAL ZERO*	Conductance (resistance) calibration zero.
214	*Conduct CAL SPAN*	Conductance (resistance) calibration span.
216	*ADC Setpt Zero*	Analog setpoint zero.
217	*ADC Setpt Span*	Analog setpoint span.
220	*ADC Feedbck Zero*	Analog Feedback zero.
221	*ADC Feedbck Span*	Analog Feedback span.

5.2 Calibration: Vin, Vout, Iin, Iout, KWout, Conductance

This describes the simplest method to adjust the calibration parameters.

You must have some form of digital communication to perform these steps and enter new calibration values. You may do this via DeviceNet or the local serial ports.

Zero Calibration of Electrical Measurements
The majority of zero calibration is self-calibrated. The residual error, even if left uncalibrated should be less than 1%.

197	VinRMS Unscaled
198	Vin CAL ZERO

200	VoutRMS Unscaled
201	Vout CAL ZERO

203	IinRMS Unscaled
204	Iin CAL ZERO

206	IoutRMS Unscaled
207	Iout CAL ZERO

209	KWout Unscaled
210	KWout CAL ZERO

212	Conduct Unscaled
213	Conduct CAL ZERO

1. Disconnect the input voltage to the SCRs, so that all electrical readings are at zero.
2. Record the top "unscaled" value of each pair shown above. The value should be between 0 and 100.
3. Copy the value recorded from the "unscaled" parameter to the lower "ZERO" parameter. This number must be form 0 to 100.
4. Done.

Span Calibration of Electrical Measurements
The majority of calibration is provided by using standard voltage transformers and current transformers. These steps may be used for fine calibration.

199	Vin CAL SPAN
5	Vin Actual RMS%
4	Vin Actual RMS

202	Vout CAL SPAN
11	Vout Actual RMS%
10	Vout Actual RMS

205	Iin CAL SPAN
3	Iin Actual RMS%
2	Iin Actual RMS

208	Iout CAL SPAN
9	Iout Actual RMS%
8	Iout Actual RMS

211	KWout CAL SPAN
13	KWout Actual%
12	KWout Actual

214	Conduct CAL SPAN
20	Conductance%

1. Apply input voltage to the SCRs with a load as close to 100% of the unit rating as possible.
2. Change the *Auto RegMode* to 6 = Open Loop to eliminate regulation and set the command setpoint to 100%. (The setpoint may be controlled using the analog input, DeviceNet, or a local HMI.)
3. Measure the electrical values using calibrated lab meters. Monitor the parameters calculated by the unit. You may use either the percentage parameters, or the engineering unit parameters.
4. Adjust the measure value by raising or lowering the value stored in the SPAN parameter for each value. The default value is 4095. This value is divided by 4095 to create a multiplier to adjust the final value. 4095/4095=1.
5. The easiest method is to just adjust the value in decades. Add or subtract by 100 to

raise or lower the meter reading. If the change is too great, back off and adjust by 10s and then 1s.

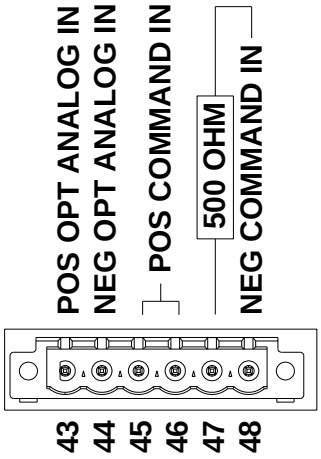
6. Alternatively, you may calculate the desired value. Determine if you wish to raise or lower the meter reading and by what percent. If you start with a SPAN of 4095 and you wish to increase the meter reading by 1%, multiply 4095 by 1% to get the new value. 4095*1.01=4135. The new value of 4136/4095=1.01 is the new correction multiplier.

5.3 Calibration: Analog Setpoint and Analog Feedback

The default values in firmware approximate calibration for a 2-10V (4-20 mA) input for both inputs. Calibration is used to fine tune these values.

If a different input range is needed, such as 0-10V, then a larger calibration change is needed.

The goal of calibration is to derive a value from 0-10000 (100.00%) when the input goes from min to max for Parameter 218, *Analog Setpoint%*, and Parameter 222, *Analog Feedback%*.



These values are signed integers, so an input below min will result in a negative number. For example, a 4-20 mA transmitter is considered to have a value of about –2500 (-25.00%) at 0 mA.

Zero Calibration of Analog Inputs

For analog inputs of process signals, we recommend leaving a small deadband to assure you can always reach 0 and 100%. For example, if you are using a 4-20 mA signal, you may want to calibrate zero at 4.1mA and 100% at 19.9 mA.

215	ADC Setpoint Raw		219	ADC Feedbck Raw
216	ADC Setpt Zero		220	ADC Feedbck Zero

1. Apply a simulated signal to the input representing 0%.
2. Copy the value in the top “Raw” value to the lower “Zero” value

Span Calibration of Analog Inputs

217	ADC Setpt Span		221	ADC Feedbck Span
218	Analog Setpoint%		222	Analog Feedback%

1. Increase the simulated input signal to the 100% value.
2. Adjust the “Span” value up or down to adjust the lower value to 100.00%
3. The simplest method is to change the “Span” value by 100s, then 10s, and then 1’s.
4. Recheck the value of Analog Setpoint% and Analog Feedback% while you run the input signal over the full range from 0-20 mA, or 0-10V, if that is your desired range. These values are signed integers, so an input below your zero calibration

point will generate a negative number.

For example, if calibrated perfectly for a 4-20 mA signal a 0 mA should produce a reading of about –2500 (-25.00% with decimal added). At 4 mA, the value should be very close to 0. At 20 mA, the value should be very close to +10000 (+100.00% with decimal).

If you calibrate a 4-20 mA signal at 4.1 mA and 19.9 mA, 4 mA will produce a slightly negative value, and 20 mA will produce a value slightly above 10000.

Negative values will be internally clamped to zero when used as the regulation setpoint.

6 DEVICENET PARAMETERS DEFINITIONS

6.1 Introduction

This section details the parameter groups and provides detailed parameter definitions. This details the parameters listed in the EDS (electronic data sheet).

All configuration, calibration, and control parameters are exposed in the EDS. The primary use of the EDS is with RSNetWorx to configure the unit with the desired characteristics. The control parameters are normally used within the context of I/O polling from the DeviceNet scanner, but manual control is possible for testing or diagnostics. Calibration parameters may be modified via the network, but is likely to be done more conveniently using other tools connected to the local serial ports since other local meters and load manipulation may be required.

In addition to DeviceNet, the unit has provisions to optionally connect a local HMI control panel, or other computer, to local serial ports. These local ports use Modbus protocol. The definitions in this section include a cross reference to the Modbus Coil and Register addressing that may be used to access the same data. The Modbus cross-referencing information is for programmer convenience and is unrelated to the DeviceNet specification and operation.

6.2 Parameter Group Listing

The DeviceNet EDS provides a parameter groups section. The logical grouping of related parameters provides an easy way to access and better understand related items. Rockwell's RSNetWorx for DeviceNet allows parameters to be displayed sequentially or by groups during configuration.

The unit has sixteen groups. The groups and parameters are listed in the following set of tables.

Table 20 Parameter Groups: Parameter Number + Name

SCR Assy Data Group	SCR Assy Data Group	Limits Setup Group	Ramp Rates Setup Group
44 KVAin Rating	55 Firing Mode Sel ⚑	51 Iin RMS% Limit ⚑	61 Ramp Up Time ⚑
45 KWout Rating	56 PFZF Dly Timer(r) ⚑	52 Vout RMS% Limit ⚑	62 Ramp Down Time ⚑
46 Vin PT Primary ⚑	57 ZFT SPD Selector ⚑	53 Iout RMS% Limit ⚑	
47 Vout PT Primary ⚑	58 ZFT Walk Up Time ⚑	54 KW Output% Limit ⚑	
48 Current XFMR Cnt ⚑	59 ZFT Rep Cycle% ⚑		
49 Iin XFMR Rating ⚑	60 Slew Rate Limit ⚑		
50 Iout XFMR Rating ⚑			

⚑ Flag indicates configuration parameter.

Table 20 continued…

Advanced Setup Group		Alarm Setup Group		mA DAC Setup Group		Reg PI Setup Group	
137	Warning Mask ⚑	33	Vin High% ⚑	117	DAC Out1 FS ⚑	21	Vout Prop Gain ⚑
138	Fault Mask ⚑	34	Vin Low% ⚑	118	DAC Out2 FS ⚑	22	Vout Integ Gain ⚑
139	Relay Mask ⚑	35	Iin PeakFault% ⚑	119	DAC Out3 FS ⚑	23	Iout Prop Gain ⚑
140	Invert Discretes ⚑	36	Iin Peak Retry ⚑	120	DAC Out1 Select ⚑	24	Iout Integ Gain ⚑
141	NetFaultMode ⚑	37	Iin Peak Timer ⚑	121	DAC Out2 Select ⚑	25	KWout Prop Gain ⚑
142	NetIdleMode ⚑	38	Iin RMS OL% ⚑	122	DAC Out3 Select ⚑	26	KWout Integ Gain ⚑
195	AutoRun ⚑	39	Iin RMS OL Timer ⚑			27	Resist Prop Gain ⚑
196	Auto RegMode NV ⚑	40	Res Ratio High ⚑			28	Resist Integ Gain ⚑
		41	Res Ratio Low ⚑			29	ExtFB Prop Gain ⚑
		42	Freq Deviation ⚑			30	ExtFB Integ Gain ⚑
		43	Ambient OT Limit ⚑			31	Iin Prop Gain ⚑
						32	Iin Integ Gain ⚑

Table 20 continued…

DeviceNet Setup Group		Control Group		Metering Group		Monitor Parameters Group	
63	ZeroWord	123	Run1	1	Iin Actual Peak%	19	Status Auxiliary
64	Firmware Rev	124	Remote Relay Req	2	Iin Actual RMS	152	Faulted
65	MAC ID Switch	125	FaultRst	3	Iin Actual RMS%	153	Warning
66	Baud Switch	126	NetKW Hour Reset	4	Vin Actual RMS	154	Running1
67	NV Dnet MAC ID	127	Net PFZF Select	5	Vin Actual RMS%	155	SCR AC In Status
68	NV Dnet Baud	128	NetCtrl	6	KVAin Actual	156	Ready
69	AssyWord0 Param ⚑	129	NetRef	7	KVAin Actual%	157	CtrlFromNet
70	AssyWord1 Param ⚑	130	ForceFault Trip	8	Iout Actual RMS	158	RefFromNet
71	AssyWord2 Param ⚑	132	Auto RegMode	9	Iout Actual RMS%	159	At Setpoint
72	AssyWord3 Param ⚑	133	Net Setpoint%	10	Vout Actual RMS	160	CtrlFromLocal
73	AssyWord4 Param ⚑	134	DAC Out1 Ref	11	Vout Actual RMS%	161	RefFromLocal
74	AssyWord5 Param ⚑	135	DAC Out2 Ref	12	KWout Actual	162	RefFromAnalog
75	AssyWord6 Param ⚑	136	DAC Out3 Ref	13	KWout Actual%	163	Relay State
76	AssyWord7 Param ⚑			14	Ambient Temp C	164	Enable Output
77	AssyWord8 Param ⚑			15	Frequency Actual	165	Max Duty Cycle
78	AssyWord9 Param ⚑			16	Nom Input Freq	166	Summary Limiting
79	AssyWord10 Param ⚑			17	Power Factor	167	INPUT1 Discrete
80	Output Assembly ⚑			18	Resistance Ratio	168	Limit Bit Status
81	Input Assembly ⚑			20	Conductance%	169	Internal Exc
223	Program Lock ⚑			218	Analog Setpoint%	170	Warning Status
				222	Analog Feedback%	171	Fault Status
						172	Relay Status
						173	WarnCode
						174	FaultCode
						175	RelayCode
						176	Setpoint Actual%
						177	Reg Mode Actual
						178	DutyCycle Actual
						179	DAC Out1 Actual
						180	DAC Out2 Actual
						181	DAC Out3 Actual
						182	FiringModeActual
						183	Local Setpoint%
						184	Local RegMode

⚑ Flag indicates configuration parameter.

Table 20 continued…

Timers Group	Event Log Group	A/B Serial Ports Group	Calibration Group
143 Control Time On	82 Log Config ⚑	99 Modbus A Addr ⚑	197 VinRMS Unscaled
144 Control Time Lsb	83 Log Count	100 ABaud Rate ⚑	198 Vin CAL ZERO
145 Control Time Msb	84 Log Last ID	101 Aparity/StopBits ⚑	199 Vin CAL SPAN
146 Output Time On	85 Log Last T Lsb	102 Modbus B Addr ⚑	*5 Vin Actual RMS%
147 Output Time Lsb	86 Log Last T Msb	103 Bbaud Rate ⚑	
148 Output Time Msb	87 Log Last Event	104 Bparity/StopBits ⚑	200 VoutRMS Unscaled
149 KW-Hour Meter	88 Log Last Data1	105 ARtnBusMsgCt	201 Vout CAL ZERO
150 KW-hour Lsb	89 Log Last Data2	106 ARtnBusComErrCt	202 Vout CAL SPAN
151 KW-hour Msb	90 Log Last Data3	107 ARtnSlaveExErrCt	*11 Vout Actual RMS%
	91 Log View ID REQ	108 ARtnSlaveMsgCt	
	92 Log View ID	109 ARtnSlaveNoRspCt	203 IinRMS Unscaled
	93 Log View T Lsb	110 AbuffOverflowCt	204 Iin CAL ZERO
	94 Log View T Msb	111 BRtnBusMsgCt	205 Iin CAL SPAN
	95 Log View Event	112 BRtnBusComErrCt	*3 Iin Actual RMS%
	96 Log View Data1	113 BRtnSlaveExErrCt	
	97 Log View Data2	114 BRtnSlaveMsgCt	206 IoutRMS Unscaled
	98 Log View Data3	115 BRtnSlaveNoRspCt	207 Iout CAL ZERO
	193 Log Last Time	116 BbuffOverflowCt	208 Iout CAL SPAN
	194 Log View Time		*9 Iout Actual RMS%
			209 KWout Unscaled
			210 KWout CAL ZERO
			211 KWout CAL SPAN
			*13 KWout Actual%
			212 Conduct Unscaled
			213 Conduct CAL ZERO
			214 Conduct CAL SPAN
			*20 Conductance%
			215 ADC Setpoint Raw
			216 ADC Setpt Zero
			217 ADC Setpt Span
			*218 Analog Setpoint%
			219 ADC Feedbck Raw
			220 ADC Feedbck Zero
			221 ADC Feedbck Span
			*222 Analog Feedback%
			* Metering Parameters 3, 5, 9, 11, 13, 20, 218, and 219 are also included in this group.

⚑ Flag indicates configuration parameter.

6.3 SCR Assy Data Group

KVAin Rating Unit KVA rating = Vin PT Primary * Iin XFMR Rating	**Param Number**	**44**
	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-59
	Group	SCR Assy Data
	Units	KVA
	Minimum Value	1.8
	Maximum Value	720.0
	Default Value	28.8
	Nonvolatile	Not applicable
Modbus Serial Port Access	Register	40069
	Access Rule	Get

KWout Rating Unit KWout rating = Vout PT Primary * Iout XFMR Rating	**Param Number**	**45**
	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-60
	Group	SCR Assy Data
	Units	KW
	Minimum Value	1.8
	Maximum Value	720.0
	Default Value	28.8
	Nonvolatile	Not applicable
Modbus Serial Port Access	Register	40070
	Access Rule	Get

Vin PT Primary Vin potential transformer must be wired using the appropriate voltage tap. This is the value used for metering when the input voltage is at 100% of the nominal input voltage rating. This number is used to scale percentages to engineering units for metering.	**Param Number**	**46**
	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-61
	Group	SCR Assy Data
	Units	V
	Minimum Value	60
	Maximum Value	600
	Default Value	480
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40071
	Access Rule	Get / Set

Vout PT Primary Vout potential transformer must be wired using the appropriate voltage tap. This is the value used for metering when the output voltage is at 100% of the nominal output voltage rating. This number is used to scale percentages to engineering units for metering.	**Param Number**	**47**
	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-62
	Group	SCR Assy Data
	Units	V
	Minimum Value	60
	Maximum Value	600
	Default Value	480
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40072
	Access Rule	Get / Set

Current XFMR Cnt	**Param Number**	**48**
Current transformer count used in the physical installation 1 = One transformer is installed and shall be used for input and output current measurements. 2 = Two transformers are installed. A second CT may be located on a power transformer secondary.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-63
	Group	SCR Assy Data
	Units	None
	Minimum Value	1
	Maximum Value	2
	Default Value	1
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40073
	Access Rule	Get / Set

Iin XFMR Rating	**Param Number**	**49**
5A secondary CTs are used. This is value used for metering when the input current is a full load (5A on CT secondary). This number is used to scale percentages to engineering units for metering.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-64
	Group	SCR Assy Data
	Units	A
	Minimum Value	30
	Maximum Value	1200
	Default Value	60
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40074
	Access Rule	Get / Set

Iout XFMR Rating	**Param Number**	**50**
5A secondary CTs are used. This is value used for metering when the input current is a full load (5A on CT secondary). This number is used to scale percentages to engineering units for metering.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-65
	Group	SCR Assy Data
	Units	A
	Minimum Value	30
	Maximum Value	1200
	Default Value	60
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40075
	Access Rule	Get / Set

6.4 FiringMode Setup Group

Firing Mode Sel	**Param Number**	**55**
Firing mode select. Firing Mode Sel 0 = ZF, Zero Fire, Variable Timebase 1 = PF, Phase Fire (default) 2 = ZFT, Zero Fire into Transformer 3 = PFZF Data Switch 4 = PFZF Discrete SW 5 = PFZF Timed SW	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-101
	Group	FiringMode Setup
	Units	None
	Minimum Value	0
	Maximum Value	5
	Default Value	1
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40111
	Access Rule	Get / Set

PFZF Dly Time(r)	**Param Number**	**56**
Applicable if 'Firing Mode Sel' = 5. Time delay to determine how long the unit uses phase firing mode at each SCR enable. DOUBLE FUNCTION PARAMETER: If 'Firing Mode Sel' = 5 AND the internal timer is actively counting the phase-fire period, this will display the clock value counting down seconds. After reaching the terminal count, it reverts to displaying the configured delay.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-102
	Group	FiringMode Setup
	Units	Sec
	Minimum Value	10
	Maximum Value	9999
	Default Value	360
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40112
	Access Rule	Get / Set

ZFT SPD Selector	**Param Number**	**57**
ZFT Starting Point Delay Selector (Randomizes firing time for multiple units) 0 = Base on DeviceNet address 1 = Base on Modbus RS-485 Address (lower 6 bits) Variable Time Delay is added to unit startup based on address to randomize the firing of zero fire units.	Access Rule	Get / Set
	Data Type	BOOL
	Object Mapping	65_{hex}-1-103
	Group	FiringMode Setup
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40113
	Access Rule	Get / Set

ZFT Walk Up Time	**Param Number**	**58**
Number of cycles for initial ramp up with ZFT firing.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-104
	Group	FiringMode Setup
	Units	None
	Minimum Value	3
	Maximum Value	10
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40114
	Access Rule	Get / Set

ZFT Rep Cycle%	**Param Number**	**59**
Percent firing angle for first half cycle of each repetitive firing sequence.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-105
	Group	FiringMode Setup
	Units	%
	Minimum Value	10
	Maximum Value	90
	Default Value	50
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40115
	Access Rule	Get / Set

Slew Rate Limit	**Param Number**	**60**
Only applicable to PF-phase firing. Limits slew rate of SCR firing control. Enter the number of cycles for a 100% change in power. This slew rate limit is applied independently from the setpoint ramp-up and ramp-down limits.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-106
	Group	FiringMode Setup
	Units	None
	Minimum Value	3
	Maximum Value	1000
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40116
	Access Rule	Get / Set

6.5 Limits Setup Group

Iin RMS% Limit	**Param Number**	**51**
Sets input current limit point used with PF-phase fire mode. For other firing modes, this will generate a limiting flag but will not influence SCR operation. Setting value to 0 disables current limiting.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-69
	Group	Limits Setup
	Units	%
	Minimum Value	0
	Maximum Value	150
	Default Value	110
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40079
	Access Rule	Get / Set

Vout RMS% Limit	**Param Number**	**52**
Sets output voltage limit point used with PF-phase fire mode. For other firing modes, this will generate a limiting flag but will not influence SCR operation. Setting value to 0 disables voltage limiting.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-70
	Group	Limits Setup
	Units	%
	Minimum Value	0
	Maximum Value	125
	Default Value	110
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40080
	Access Rule	Get / Set

Iout RMS% Limit	**Param Number**	**53**
Sets output current limit point used with PF-phase fire mode. For other firing modes, this will generate a limiting flag but will not influence SCR operation. Setting value to 0 disables current limiting.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-71
	Group	Limits Setup
	Units	%
	Minimum Value	0
	Maximum Value	150
	Default Value	110
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40081
	Access Rule	Get / Set

KW Output% Limit	**Param Number**	**54**
Sets output KW limit point used with PF-phase fire mode. For other firing modes, this will generate a limiting flag but will not influence SCR operation. Setting value to 0 disables power limiting.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-72
	Group	Limits Setup
	Units	%
	Minimum Value	0
	Maximum Value	125
	Default Value	110
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40082
	Access Rule	Get / Set

6.6 Ramp Rates Setup Group

Ramp Up Time ⚑ Limit applied to any command setpoint to determine the 'Setpoint Actual%'.	**Param Number**	**61**
	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-99
	Group	Ramp Rates Setup
	Units	Sec
	Minimum Value	0
	Maximum Value	360
	Default Value	2
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40109
	Access Rule	Get / Set

Ramp Down Time ⚑ Limit applied to any command setpoint to determine the 'Setpoint Actual%'.	**Param Number**	**62**
	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-100
	Group	Ramp Rates Setup
	Units	Sec
	Minimum Value	0
	Maximum Value	360
	Default Value	2
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40110
	Access Rule	Get / Set

6.7 Advanced Setup Group

Warning Mask	**Param Number**	**137**
Selects conditions that will generate a warning condition. Bit 0 = Comm Fault Bit 1 = Comm Idle *Bit 2 = High Ambient Bit 3 = SCRShort/OutOpen Bit 4 = Vin RMS High Bit 5 = Vin RMS Low Bit 6 = Summary Limiting Bit 7 = Frequency Deviation Bit 8 = Iin Timed OL Bit 9 = SCR Short/w Amps Bit 10 = Load Res High (Vout>10%) Bit 11 = Load Res Low (Vout>10%) Bit 12 = Fuse Switch Out Bit 13 = Max Duty Cycle Bit 14 = Internal Exc Bit 15 = Reserved15 * = default selection	Access Rule	Get / Set
	Data Type	WORD
	Object Mapping	$8D_{hex}$-1-104
	Group	Advanced Setup
	Units	None
	Minimum Value	0
	Maximum Value	0xFFFF
	Default Value	0x0004
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40106
	Access Rule	Get / Set

Fault Mask	**Param Number**	**138**
Selects conditions that will generate a faulted condition if the corresponding alarm is true.. Bit 0 = INPUT1 *Bit 1 = Heatsink OT Bit 2 = High Ambient Bit 3 = SCRShort/OutOpen Bit 4 = Vin RMS High Bit 5 = Vin RMS Low Bit 6 = Reserved6 Bit 7 = Iin Peak Fault Bit 8 = Iin Timed OL Bit 9 = Reserved9 Bit 10 = Reserved10 Bit 11 = Comm Fault (DeviceNet) Automatically set and cleared by 'NetFaultMode'. Bit 12 = Comm Idle (DeviceNet) Automatically set and cleared by 'NetIdleMode'. Bit 13 = Warning *Bit 14 = External Fault (mandatory) Automatically set = 1. Bit 15 = Reserved15 * = default selection	Access Rule	Get / Set
	Data Type	WORD
	Object Mapping	$8D_{hex}$-1-105
	Group	Advanced Setup
	Units	None
	Minimum Value	0
	Maximum Value	0xFFFF
	Default Value	0x4002
	Nonvolatile	Yes Exceptions - Writes to these bits are ignored. Bit 11 Controlled by 'NetFaultMode' Bit 12 Controlled by 'NetIdleMode' Bit 14 Always = 1
Modbus Serial Port Access	Register	40107
	Access Rule	Get / Set

Relay Mask	**Param Number**	**139**
Selects conditions that will generate an active relay condition. Bit 0 = INPUT1 Bit 1 = Heatsink OT Bit 2 = High Ambient Bit 3 = SCRShort/OutOpen Bit 4 = Vin RMS High Bit 5 = Vin RMS Low Bit 6 = Warning Bit 7 = Frequency Deviation *Bit 8 = Fault Bit 9 = SCR Short/w Amps Bit 10 = Load Res High (Vout>10%) Bit 11 = Load Res Low (Vout>10%) Bit 12 = Fuse Switch Out Bit 13 = Local Relay Req Bit 14 = Remote Relay Req (DeviceNet) Bit 15 = Reserved15 * = default selection	Access Rule	Get / Set
	Data Type	WORD
	Object Mapping	$8D_{hex}$-1-106
	Group	Advanced Setup
	Units	None
	Minimum Value	0
	Maximum Value	0xFFFF
	Default Value	0x0100
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40108
	Access Rule	Get / Set

Invert Discretes	**Param Number**	**140**
Discrete input point logic selection. For Bits 0-4, set to 0 if an open connector (low) is the false state. Set to 1 if a (high) 10V input is the false state. See Table 21 Invert Discrete Logic Table. Discrete Inputs: Bit 0 = INPUT1 (normally open) Bit 1 = Output Enable (normally open) Bit 2 = External Fault (normally open) Bit 3 = Fuse Switch (normally open) Bit 4 = Heatsink OT (default thermostat-normally open) Bit 5 = Optional Internal Input (reserved) Bit 6-14 = Reserved Discrete Output: Bit 15 = Relay Output *0 = Energize on ActiveState (normal) 1 = Energize on Non-Active State (as long as unit is powered) * = default selection	Access Rule	Get / Set
	Data Type	WORD
	Object Mapping	65_{hex}-1-68
	Group	Advanced Setup
	Units	None
	Minimum Value	0
	Maximum Value	0xFFFF
	Default Value	0x0000
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40078
	Access Rule	Get / Set

The following table lists the values of the discrete inputs and output, the value of *Invert Discretes* and the value of the monitored or control parameter.

Table 21 Invert Discrete Logic Table

Discrete Input (First five use pull-down resistors)	***Invert Discrete* Bit Values**	**Monitored Parameter**
INPUT1 (low) Open terminal = 0V input	xxxx xxxx xxxx xxx0	*INPUT1 Discrete* = 0
	xxxx xxxx xxxx xxx1	*INPUT1 Discrete* = 1
INPUT1 (high) Connect Term. 25-26 or apply 10V = 10V input	xxxx xxxx xxxx xxx0	*INPUT1 Discrete* = 1
	xxxx xxxx xxxx xxx1	*INPUT1 Discrete* = 0
ENABLE OUTPUT (low) Open terminal = 0V input	xxxx xxxx xxxx xx0x	*Enable Output* = 0
	xxxx xxxx xxxx xx1x	*Enable Output* = 1
ENABLE OUTPUT (high) Connect Term. 28-29 or apply 10V = 10V input	xxxx xxxx xxxx xx0x	*Enable Output* = 1
	xxxx xxxx xxxx xx1x	*Enable Output* = 0
EXTERNAL FAULT (low) Open terminal = 0V input	xxxx xxxx xxxx x0xx	*Status Auxiliary*:bit 15 = 0
	xxxx xxxx xxxx x1xx	*Status Auxiliary*:bit 15 = 1
EXTERNAL FAULT (high) Connect Term. 31-32 or apply 10V = 10V input	xxxx xxxx xxxx x0xx	*Status Auxiliary*:bit 15 = 1
	xxxx xxxx xxxx x1xx	*Status Auxiliary*:bit 15 = 0
FUSE SWITCH (low) (internal) Open terminal = 0V input	xxxx xxxx xxxx 0xxx	*Status Auxiliary*:bit 9 = 0
	xxxx xxxx xxxx 1xxx	*Status Auxiliary*:bit 9 = 1
FUSE SWITCH (high) (internal) Connect Term. 49-50 or apply 10V = 10V input	xxxx xxxx xxxx 0xxx	*Status Auxiliary*:bit 9 = 1
	xxxx xxxx xxxx 1xxx	*Status Auxiliary*:bit 9 = 0
HEATSINK THERMOSTAT (low) (internal) Open terminal = 0V input	xxxx xxxx xxx0 xxxx	*Status Auxiliary*:bit 4 = 0
	xxxx xxxx xxx1 xxxx	*Status Auxiliary*:bit 4 = 1
HEATSINK THERMOSTAT (high) (internal) Connect Term. 51-52 or apply 10V = 10V input	xxxx xxxx xxx0 xxxx	*Status Auxiliary*:bit 4 = 1
	xxxx xxxx xxx1 xxxx	*Status Auxiliary*:bit 4 = 0
SPARE FUTURE USE (high) (internal) Open terminal (pull-up resistor) = 5V input	xxxx xxxx xx0x xxxx	*Status Auxiliary*:bit 14 = 1
	xxxx xxxx xx1x xxxx	*Status Auxiliary*:bit 14 = 0
SPARE FUTURE USE (low) (internal) Connect to com = 0V input (Term. 53 to 54)	xxxx xxxx xx0x xxxx	*Status Auxiliary*:bit 14 = 0
	xxxx xxxx xx1x xxxx	*Status Auxiliary*:bit 14 = 1

Control Parameter (Based on *Relay Mask* and its input flags)	***Invert Discrete* Bit Value** (If 1, relay is normally energized and drops out when active or no power)	**Discrete Output Relay Coil**
***Relay State* = 0 (relay is in non-active state)**	0xxx xxxx xxxx xxxx	Not Energized
	1xxx xxxx xxxx xxxx	Energized
***Relay State* = 1 (relay is in active state)**	0xxx xxxx xxxx xxxx	Energized
	1xxx xxxx xxxx xxxx	Not Energized

NetFaultMode	**Param Number**	**141**
This attribute establishes the mode of operation on loss of network communication (no established connections). 0 = Fault and Stop, bit automatically set in 'Fault Mask'. Clears 'NetCtrl', 'NetRef', 'Run1', 'Remote Relay Req', 'Net PFZF Select', and 'Net_Setpoint'. 1 = Ignore (Warning optional depending on bit setting in 'Warning Mask'). This will allow the controller to continue in its current operation mode at time of network event. If running from network control, 'NetCtrl', 'NetRef', 'Run1', 'Remote Relay Req', 'Net PFZF Select', and 'Net_Setpoint' will remain unchanged. 2 = Clears 'NetCtrl', 'NetRef', 'Run1', 'Remote Relay Req', 'Net PFZF Select', and 'Net_Setpoint'. Does not Fault and Stop. Resulting operation will depend on internal/local controls. (Warning optional).	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	$8D_{hex}$-1-16
	Group	Advanced Setup
	Units	None
	Minimum Value	0
	Maximum Value	2
	Default Value	1
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40123
	Access Rule	Get / Set

NetIdleMode	**Param Number**	**142**
The NetIdleMode attribute establishes the mode of operation on reception of network Idle communication. 0 = Fault and Stop, bit automatically set in 'Fault Mask'. Clears 'NetCtrl', 'NetRef', 'Run1', 'Remote Relay Req', 'Net PFZF Select', and 'Net_Setpoint'. 1 = Ignore (Warning optional depending on bit setting in 'Warning Mask'). This will allow the controller to continue in its current operation mode at time of network event. If running from network control, 'NetCtrl', 'NetRef', 'Run1', 'Remote Relay Req', 'Net PFZF Select', and 'Net_Setpoint' will remain unchanged. 2 = Clears 'NetCtrl', 'NetRef', 'Run1', 'Remote Relay Req', 'Net PFZF Select', and 'Net_Setpoint'. Does not Fault and Stop. Resulting operation will depend on internal/local controls. (Warning optional).	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	$8D_{hex}$-1-20
	Group	Advanced Setup
	Units	None
	Minimum Value	0
	Maximum Value	2
	Default Value	1
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40124
	Access Rule	Get / Set

AutoRun	**Param Number**	**195**
Absent Network or Local overrides, this value serves as the internal run/stop command. 0 = Stop 1 = Run automatically on startup/reset.	Access Rule	Get / Set
	Data Type	BOOL
	Object Mapping	65_{hex}-1-67
	Group	Advanced Setup
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	1
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40077
	Access Rule	Get / Set

Auto RegMode NV	**Param Number**	**196**
This value is loaded into *'Auto RegMode'* on power-up. 1 = Voltage 2 = Current 3 = Power 4 = Resistance 5 = Analog Feedback% (User's circuit must provide feedback) 6 = Open Loop	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	65_{hex}-1-66
	Group	Advanced Setup
	Units	None
	Minimum Value	1
	Maximum Value	6
	Default Value	1
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40076
	Access Rule	Get / Set

6.8 Alarm Setup Group

Vin High%	**Param Number**	**33**
High fault level for Vin RMS, as a percent of 100% unit. 2% Hysterysis.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-85
	Group	Alarm Setup
	Units	%
	Minimum Value	25
	Maximum Value	150
	Default Value	125
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40095
	Access Rule	Get / Set

Vin Low%	**Param Number**	**34**
Trip at 85%, come back at 87% as a percent of 100% unit rating. 2% Hysterysis.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-86
	Group	Alarm Setup
	Units	%
	Minimum Value	25
	Maximum Value	100
	Default Value	85
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40096
	Access Rule	Get / Set

Iin PeakFault%	**Param Number**	**35**
Peak input current for two consecutive cycles that will cause a trip. Automatic reset, or a permanent faulted condition, is possible depending upon the settings of the 'Iin Peak Retry' count, the seconds specified in 'Iin Peak Timer', and the number of trips occurring within the timer period. Setting value to 0 disables peak overcurrent detection. IMPORTANT: If nonzero, you must enable this flag in the Fault Mask to enable it to generate a fault based on 'Iin Peak Retry' and 'Iin Peak Timer', or it will just generate a reset and restart with no potential limit.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-87
	Group	Alarm Setup
	Units	%
	Minimum Value	0
	Maximum Value	300
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40097
	Access Rule	Get / Set

Iin Peak Retry	**Param Number**	**36**
Number of retries allowed within retry time for input peak current overloads.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-88
	Group	Alarm Setup
	Units	None
	Minimum Value	0
	Maximum Value	8
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40098
	Access Rule	Get / Set

Iin Peak Timer	**Param Number**	**37**
Time limit for fault retries before 'Iin Peak Fault' is declared if other conditions are met.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-89
	Group	Alarm Setup
	Units	Sec
	Minimum Value	10
	Maximum Value	600
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40099
	Access Rule	Get / Set

Iin RMS OL%	**Param Number**	**38**
Level of RMS input current that may cause a timed fault if limit is continuously exceeded beyond the time set in 'Iin RMS OL Timer'. If the current dips below this value, the timing period restarts.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-90
	Group	Alarm Setup
	Units	%
	Minimum Value	0
	Maximum Value	200
	Default Value	125
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40100
	Access Rule	Get / Set

Iin RMS OL Timer	**Param Number**	**39**
Time limit for RMS input Current.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-91
	Group	Alarm Setup
	Units	Sec
	Minimum Value	10
	Maximum Value	600
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40101
	Access Rule	Get / Set

Res Ratio High	**Param Number**	**40**
If 'Load Resistance Ratio' exceeds this setting for 10 seconds while Vout is greater than 10%, then high Resistance Warning is TRUE.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-92
	Group	Alarm Setup
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	10000
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40102
	Access Rule	Get / Set

Res Ratio Low	**Param Number**	**41**
If 'Load Resistance Ratio' is less than this setting for 10 seconds while Vout is greater than 10%, the low resistance warning is TRUE.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-93
	Group	Alarm Setup
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40103
	Access Rule	Get / Set

Freq Deviation	**Param Number**	**42**
'+/- Frequency deviation from nominal that triggers an alarm. AC Input will be disqualified below 46Hz and above 64Hz.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-94
	Group	Alarm Setup
	Units	Hz
	Minimum Value	1
	Maximum Value	4
	Default Value	4
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40104
	Access Rule	Get / Set

Ambient OT Limit	**Param Number**	**43**
Alarm setpoint for DSP ambient temperature alarm. This is an inside ambient temperature that will run higher than the outside ambient air temperature.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-95
	Group	Alarm Setup
	Units	°C
	Minimum Value	0
	Maximum Value	85
	Default Value	75
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40105
	Access Rule	Get / Set

6.9 mA DAC Setup Group

DAC Out1 FS	**Param Number**	**117**
Defines DAC data value representing 100% when 'Analog Out1 Selector' = 1-10. If this value is less than 65535, then the transmitter may send data representing more than 100% for metering values that can exceed 100% of the nominal unit rating.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-107
	Group	mA DAC Setup
	Units	None
	Minimum Value	16383
	Maximum Value	65535
	Default Value	65535
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40117
	Access Rule	Get / Set

DAC Out2 FS	**Param Number**	**118**
Defines DAC data value representing 100% when 'Analog Out2 Selector' = 1-10. If this value is less than 65535, then the transmitter may send data representing more than 100% for metering values that can exceed 100% of the nominal unit rating.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-108
	Group	mA DAC Setup
	Units	None
	Minimum Value	16383
	Maximum Value	65535
	Default Value	65535
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40118
	Access Rule	Get / Set

DAC Out3 FS	**Param Number**	**119**
Defines DAC data value representing 100% when 'Analog Out3 Selector' = 1-10. If this value is less than 65535, then the transmitter may send data representing more than 100% for metering values that can exceed 100% of the nominal unit rating.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-109
	Group	mA DAC Setup
	Units	None
	Minimum Value	16383
	Maximum Value	65535
	Default Value	65535
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40119
	Access Rule	Get / Set

DAC Out1 Select	**Param Number**	**120**
0 = Fixed Min Output	Access Rule	Get / Set
1 = Vin Actual RMS%	Data Type	UINT
2 = Iin Actual RMS%	Object Mapping	65_{hex}-1-110
3 = KVAin Actual%	Group	mA DAC Setup
4 = Vout Actual RMS%	Units	None
5 = Iout Actual RMS%	Minimum Value	0
6 = KWout Actual%	Maximum Value	11
7 =Analog Setpoint%	Default Value	4
8 = Analog Feedback%	Nonvolatile	Yes
9 = Setpoint Actual%		
10 = DutyCycle Actual%		
11 = DAC Out1 Ref		
16383 = Fixed 25%		
32767 = Fixed 50%		
49151 = Fixed 75%		
65535 = Fixed 100%		
The EDS provides the above non-consecutive enumeration. Any 16-bit value is allowed. Values 1-11 steer other parameters to be the data source to drive the DAC. Values 0, and 12-65535 are used as direct, fixed data to drive the DAC creating a fixed mA source. RSNetWorx may not allow entering values not enumerated.		
12-31 =Reserved		
32-65535 = use this 'DAC Out1 Select' value as the direct DAC drive data Fixed mA output.		
Modbus Serial Port Access	Register	40120
	Access Rule	Get / Set

DAC Out2 Select	**Param Number**	**121**
0 = Fixed Minimum Output 1 = Vin Actual RMS% 2 = Iin Actual RMS% 3 = KVAin Actual% 4 = Vout Actual RMS% 5 = Iout Actual RMS% 6 = KWout Actual% 7 =Analog Setpoint% 8 = Analog Feedback% 9 = Setpoint Actual% 10 = DutyCycle Actual% 11 = DAC Out2 Ref 16383 = Fixed 25% 32767 = Fixed 50% 49151 = Fixed 75% 65535 = Fixed 100% The EDS provides the above non-consecutive enumeration. Any 16-bit value is allowed. Values 1-11 steer other parameters to be the data source to drive the DAC. Values 0, and 12-65535 are used as direct, fixed data to drive the DAC creating a fixed mA source. RSNetWorx may not allow entering values not enumerated. 12-31 =Reserved 32-65535 = use this 'DAC Out2 Select' value as the direct DAC drive data Fixed mA output.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-111
	Group	mA DAC Setup
	Units	None
	Minimum Value	0
	Maximum Value	11
	Default Value	5
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40121
	Access Rule	Get / Set

DAC Out3 Select	**Param Number**	**122**
0 = Fixed Minimum Output 1 = Vin Actual RMS% 2 = Iin Actual RMS% 3 = KVAin Actual% 4 = Vout Actual RMS% 5 = Iout Actual RMS% 6 = KWout Actual% 7 =Analog Setpoint% 8 = Analog Feedback% 9 = Setpoint Actual% 10 = DutyCycle Actual% 11 = DAC Out3 Ref 16383 = Fixed 25% 32767 = Fixed 50% 49151 = Fixed 75% 65535 = Fixed 100% The EDS provides the above non-consecutive enumeration. Any 16-bit value is allowed. Values 1-11 steer other parameters to be the data source to drive the DAC. Values 0, and 12-65535 are used as direct, fixed data to drive the DAC creating a fixed mA source. RSNetWorx may not allow entering values not enumerated. 12-31 =Reserved 32-65535 = use this 'DAC Out3 Select' value as the direct DAC drive data Fixed mA output.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-112
	Group	mA DAC Setup
	Units	None
	Minimum Value	0
	Maximum Value	11
	Default Value	6
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40122
	Access Rule	Get / Set

6.10 Reg PI Setup Group

Vout Prop Gain	**Param Number**	**21**
Proportional gain adjustment.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-73
	Group	Reg PI Setup
	Units	None
	Minimum Value	0
	Maximum Value	25
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40083
	Access Rule	Get / Set

Vout Integ Gain	**Param Number**	**22**
Integral gain adjustment.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-74
	Group	Reg PI Setup
	Units	None
	Minimum Value	0
	Maximum Value	25
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40084
	Access Rule	Get / Set

Iout Prop Gain	**Param Number**	**23**
Proportional gain adjustment.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-75
	Group	Reg PI Setup
	Units	None
	Minimum Value	0
	Maximum Value	25
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40085
	Access Rule	Get / Set

Iout Integ Gain	**Param Number**	**24**
Integral gain adjustment.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-76
	Group	Reg PI Setup
	Units	None
	Minimum Value	0
	Maximum Value	25
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40086
	Access Rule	Get / Set

KWout Prop Gain	**Param Number**	**25**
Proportional gain adjustment.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-77
	Group	Reg PI Setup
	Units	None
	Minimum Value	0
	Maximum Value	25
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40087
	Access Rule	Get / Set

KWout Integ Gain	**Param Number**	**26**
Integral gain adjustment.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-78
	Group	Reg PI Setup
	Units	None
	Minimum Value	0
	Maximum Value	25
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40088
	Access Rule	Get / Set

Resist Prop Gain	**Param Number**	**27**
Proportional gain adjustment.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-79
	Group	Reg PI Setup
	Units	None
	Minimum Value	0
	Maximum Value	25
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40089
	Access Rule	Get / Set

Resist Integ Gain	**Param Number**	**28**
Integral gain adjustment.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-80
	Group	Reg PI Setup
	Units	None
	Minimum Value	0
	Maximum Value	25
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40090
	Access Rule	Get / Set

ExtFB Prop Gain	**Param Number**	**29**
Proportional gain adjustment.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-81
	Group	Reg PI Setup
	Units	None
	Minimum Value	0
	Maximum Value	25
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40091
	Access Rule	Get / Set

ExtFB Integ Gain	**Param Number**	**30**
Integral gain adjustment.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-82
	Group	Reg PI Setup
	Units	None
	Minimum Value	0
	Maximum Value	25
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40092
	Access Rule	Get / Set

Iin Prop Gain	**Param Number**	**31**
Proportional gain adjustment.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-83
	Group	Reg PI Setup
	Units	None
	Minimum Value	0
	Maximum Value	25
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40093
	Access Rule	Get / Set

Iin Integ Gain	**Param Number**	**32**
Integral gain adjustment.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-84
	Group	Reg PI Setup
	Units	None
	Minimum Value	0
	Maximum Value	25
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40094
	Access Rule	Get / Set

6.11 DeviceNet Setup Group

ZeroWord	**Param Number**	**63**
Zero Constant Word This may be used to fill unused spaces in an input assembly.	Access Rule	Get
	Data Type	UINT
	Object Mapping	AE_{hex}-1-2
	Group	DeviceNet Setup
	Units	None
	Minimum Value	0
	Maximum Value	0
	Default Value	0
	Nonvolatile	Not applicable
Modbus Serial Port Access	Register	None
	Access Rule	

Firmware Rev	**Param Number**	**64**
Firmware revision in EDS readable form.	Access Rule	Get
	Data Type	UINT
	Object Mapping	AE_{hex}-1-3
	Group	DeviceNet Setup
	Units	None
	Minimum Value	1001 rev1.001 2001 rev2.001
	Maximum Value	65.535
	Default Value	1.001
	Nonvolatile	Not applicable
Modbus Serial Port Access	Register	40131
	Access Rule	Get

MAC ID Switch	**Param Number**	**65**
Current rotary switch value. The default switch setting is 63. A switch setting above 63 indicates that the MAC ID is programmable via the network.	Access Rule	Get
	Data Type	USINT
	Object Mapping	AE_{hex}-1-4
	Group	DeviceNet Setup
	Units	None
	Minimum Value	0
	Maximum Value	99
	Default Value	63
	Nonvolatile	Not applicable
Modbus Serial Port Access	Register	40198
	Access Rule	Get

Baud Switch	**Param Number**	**66**
Current rotary switch value. The default switch setting is 0. A switch setting above 2 indicates that the BAUD rate is programmable via the network.	Access Rule	Get
	Data Type	USINT
	Object Mapping	AE_{hex}-1-5
	Group	DeviceNet Setup
	Units	None
	Minimum Value	0
	Maximum Value	9
	Default Value	0
	Nonvolatile	Not applicable
Modbus Serial Port Access	Register	40199
	Access Rule	Get

NV Dnet MAC ID	**Param Number**	**67**
DeviceNet MAC ID stored in nonvolatile memory.	Access Rule	Get
	Data Type	USINT
	Object Mapping	AE_{hex}-1-6
	Group	DeviceNet Setup
	Units	None
	Minimum Value	0
	Maximum Value	63
	Default Value	63
	Nonvolatile	Not applicable
Modbus Serial Port Access	Register	40200
	Access Rule	Get

NV Dnet BAUD	**Param Number**	**68**
DeviceNet Baud rate stored in nonvolatile memory.	Access Rule	Get
	Data Type	USINT
	Object Mapping	AE_{hex}-1-7
	Group	DeviceNet Setup
	Units	None
	Minimum Value	0
	Maximum Value	2
	Default Value	0
	Nonvolatile	Not applicable
Modbus Serial Port Access	Register	40201
	Access Rule	Get

***AssyWord0 Param* to *AssyWord10 Param* –** These are used to determine what values are placed in DeviceNet Input Assemblies. Each is configured with a parameter number. The value contained in the specified parameter is the value placed in the assembly. The assembly you select using *Input Assembly* will determine how many of these are used. The needed values are application specific and the default values are arbitrary. While voltage, current, and power are the most used values, you may choose to use percentage value or engineering value parameters, or any others.

AssyWord0 Param	**Param Number**	**69**
Parameter number whose value is used as the 1st word in Input Assembly 152, 153, or 154. Any parameter will be placed in the assembly as a (16-bit) UINT. USINT and BOOL values will have unused bits padded with zeros. Specifying the parameter number of a (32-bit) UDINT will load undefined UINT data.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-8
	Group	DeviceNet Setup
	Units	None
	Minimum Value	1
	Maximum Value	223
	Default Value	11
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40132
	Access Rule	Get / Set

AssyWord1 Param	**Param Number**	**70**
Parameter number whose value is used as the 2nd word in Input Assembly 152, 153, or 154. Any parameter will be placed in the assembly as a (16-bit) UINT. USINT and BOOL values will have unused bits padded with zeros. Specifying the parameter number of a (32-bit) UDINT will load undefined UINT data.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-9
	Group	DeviceNet Setup
	Units	None
	Minimum Value	1
	Maximum Value	223
	Default Value	9
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40133
	Access Rule	Get / Set

AssyWord2 Param	**Param Number**	**71**
Parameter number whose value is used as the 3rd word in Input Assembly 152, 153, or 154. Any parameter will be placed in the assembly as a (16-bit) UINT. USINT and BOOL values will have unused bits padded with zeros. Specifying the parameter number of a (32-bit) UDINT will load undefined UINT data.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-10
	Group	DeviceNet Setup
	Units	None
	Minimum Value	1
	Maximum Value	223
	Default Value	13
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40134
	Access Rule	Get / Set

AssyWord3 Param	**Param Number**	**72**
Parameter number whose value is used as the 4th word in Input Assembly 152, 153, or 154. Any parameter will be placed in the assembly as a (16-bit) UINT. USINT and BOOL values will have unused bits padded with zeros. Specifying the parameter number of a (32-bit) UDINT will load undefined UINT data.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-11
	Group	DeviceNet Setup
	Units	None
	Minimum Value	1
	Maximum Value	223
	Default Value	10
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40135
	Access Rule	Get / Set

AssyWord4 Param	**Param Number**	**73**
Parameter number whose value is used as the 5th word in Input Assembly 153 or 154. Any parameter will be placed in the assembly as a (16-bit) UINT. USINT and BOOL values will have unused bits padded with zeros. Specifying the parameter number of a (32-bit) UDINT will load undefined UINT data.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-12
	Group	DeviceNet Setup
	Units	None
	Minimum Value	1
	Maximum Value	223
	Default Value	8
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40136
	Access Rule	Get / Set

AssyWord5 Param	**Param Number**	**74**
Parameter number whose value is used as the 6th word in Input Assembly 153 or 154. Any parameter will be placed in the assembly as a (16-bit) UINT. USINT and BOOL values will have unused bits padded with zeros. Specifying the parameter number of a (32-bit) UDINT will load undefined UINT data.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-13
	Group	DeviceNet Setup
	Units	None
	Minimum Value	1
	Maximum Value	223
	Default Value	12
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40137
	Access Rule	Get / Set

AssyWord6 Param	**Param Number**	**75**
Parameter number whose value is used as the 7th word in Input Assembly 153 or 154. Any parameter will be placed in the assembly as a (16-bit) UINT. USINT and BOOL values will have unused bits padded with zeros. Specifying the parameter number of a (32-bit) UDINT will load undefined UINT data.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-14
	Group	DeviceNet Setup
	Units	None
	Minimum Value	1
	Maximum Value	223
	Default Value	5
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40138
	Access Rule	Get / Set

AssyWord7 Param	**Param Number**	**76**
Parameter number whose value is used as the 8th word in Input Assembly 153 or 154. Any parameter will be placed in the assembly as a (16-bit) UINT. USINT and BOOL values will have unused bits padded with zeros. Specifying the parameter number of a (32-bit) UDINT will load undefined UINT data.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-15
	Group	DeviceNet Setup
	Units	None
	Minimum Value	1
	Maximum Value	223
	Default Value	4
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40139
	Access Rule	Get / Set

AssyWord8 Param	**Param Number**	**77**
Parameter number whose value is used as the 9th word in Input Assembly 154. Any parameter will be placed in the assembly as a (16-bit) UINT. USINT and BOOL values will have unused bits padded with zeros. Specifying the parameter number of a (32-bit) UDINT will load undefined UINT data.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-16
	Group	DeviceNet Setup
	Units	None
	Minimum Value	1
	Maximum Value	223
	Default Value	18
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40140
	Access Rule	Get / Set

AssyWord9 Param	**Param Number**	**78**
Parameter number whose value is used as the 10th word in Input Assembly 154. Any parameter will be placed in the assembly as a (16-bit) UINT. USINT and BOOL values will have unused bits padded with zeros. Specifying the parameter number of a (32-bit) UDINT will load undefined UINT data.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-17
	Group	DeviceNet Setup
	Units	None
	Minimum Value	1
	Maximum Value	223
	Default Value	3
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40141
	Access Rule	Get / Set

AssyWord10 Param	**Param Number**	**79**
Parameter number whose value is used as the 11th word in Input Assembly 154. Any parameter will be placed in the assembly as a (16-bit) UINT. USINT and BOOL values will have unused bits padded with zeros. Specifying the parameter number of a (32-bit) UDINT will load undefined UINT data.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-18
	Group	DeviceNet Setup
	Units	None
	Minimum Value	1
	Maximum Value	223
	Default Value	2
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40142
	Access Rule	Get / Set

Output Assembly	**Param Number**	**80**
This configures the power up reset value of the Output Assembly to be used for DeviceNet I/O. A change will change the size of the assembly. A change to this value only takes affect (changes the I/O connection data) on the next power up reset, or a reset to the DeviceNet Identity Object with data = 1.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-21
	Group	DeviceNet Setup
	Units	None
	Minimum Value	102
	Maximum Value	104
	Default Value	102
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40143
	Access Rule	Get / Set

Input Assembly	**Param Number**	**81**
This configures the power up reset value of the Input Assembly to be used for DeviceNet I/O. A change will change the size of the assembly. A change to this value only takes affect (changes the I/O connection data) on the next power up reset, or a reset to the DeviceNet Identity Object with data = 1.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	AE_{hex}-1-22
	Group	DeviceNet Setup
	Units	None
	Minimum Value	151
	Maximum Value	154
	Default Value	152
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40144
	Access Rule	Get / Set

Program Lock	**Param Number**	**223**
	Access Rule	Get / Set
FUTURE USE: No parameters support this at this time.	Data Type	USINT
	Object Mapping	AE_{hex}-1-20
	Group	DeviceNet Setup
	Units	None
	Minimum Value	0
	Maximum Value	5
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40146
	Access Rule	Get / Set

6.12 Control Group

Run1	**Param Number**	**123**
See run/stop event matrix and behavior. - NetCtrl and CtrlFromNet must = 1 to enable this. - Local digital control (HMI) can override this by …	Access Rule	Get / Set
	Data Type	BOOL
	Object Mapping	$8D_{hex}$-1-3
	Group	Control
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access (monitor DeviceNet IO only)	Register	40265:bit0
	Access Rule	Get

Remote Relay Req	**Param Number**	**124**
0 = Relay inactive state. 1 = Relay active state.	Access Rule	Get / Set
	Data Type	BOOL
	Object Mapping	65_{hex}-1-12
	Group	Control
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access (monitor DeviceNet IO only)	Register	40265:bit1
	Access Rule	Get

FaultRst	**Param Number**	**125**
If unit is faulted, this resets the faulted condition. This also resets the flags of alarms 'Iin Peak Fault' and 'Iin Timed OL' (even if the unit is not in a faulted condition). 0 = No action. 0->1 = Fault Reset. This parameter is automatically reset to zero when the command is executed. The master does not need to write zero to clear the value. Typically, the action will be executed and value cleared before the master can read again, so the value normally reads back as zero.	Access Rule	Get / Set
	Data Type	BOOL
	Object Mapping	$8D_{hex}$-1-12
	Group	Control
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access (monitor DeviceNet IO only)	Register	40265:bit2
	Access Rule	Get

NetKW Hour Reset	**Param Number**	**126**
0 = No action. 0->1 = Reset. This parameter is automatically reset to zero when the command is executed. The master does not need to write zero to clear the value. Typically, the action will be executed and value cleared before the master can read again, so the value normally reads back as zero.	Access Rule	Get / Set
	Data Type	BOOL
	Object Mapping	65_{hex}-1-13
	Group	Control
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access (monitor DeviceNet IO only)	Register	40265:bit3
	Access Rule	Get

Net PFZF Select	**Param Number**	**127**
Only functional if 'Firing Mode Select' = 3. 0 = Phase Firing 1 = Zero Firing, variable time base If PFZF is selected with data control, this will only control if 'CtrlFromNet' is TRUE. Otherwise, 'Local_PFZF_Select' controls.	Access Rule	Get / Set
	Data Type	BOOL
	Object Mapping	65_{hex}-1-14
	Group	Control
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access (monitor DeviceNet IO only)	Register	40265:bit4
	Access Rule	Get

NetCtrl	**Param Number**	**128**
Requests Run Stop control to be from network. 0 = Network Run1 Control ignored. AutoRun and Local digital input will control run/stop. 1 = Network Run1 Control requested. Note that the actual status of network control is reflected in attribute $8D_{hex}$-1-15, 'CtrlFromNet'. Local digital control can override Dnet control.	Access Rule	Get / Set
	Data Type	BOOL
	Object Mapping	$8D_{hex}$-1-5
	Group	Control
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access (monitor DeviceNet IO only)	Register	40265:bit5
	Access Rule	Get

NetRef	**Param Number**	**129**
Requests Setpoint Reference to be from network. 0 = Only local analog or digital control of setpoint. 1 = Requests setpoint control via DeviceNet. Note that the actual status of network control is reflected in attribute 65_{hex} -1-2, 'RefFromNet'. Local digital control can override this.	Access Rule	Get / Set
	Data Type	BOOL
	Object Mapping	65_{hex}-1-1
	Group	Control
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access (monitor DeviceNet IO only)	Register	40265:bit6
	Access Rule	Get

ForceFault Trip	**Param Number**	**130**
Network digital fault command. This will force a faulted (tripped) state. Not maskable. 0 = No action 0->1 = Initiate a fault trip. This parameter is automatically reset to zero when the command is executed. The master does not need to write zero to clear the value. Typically, the action will be executed and value cleared before the master can read again, so the value normally reads back as zero.	Access Rule	Get / Set
	Data Type	BOOL
	Object Mapping	$8D_{hex}$-1-17
	Group	Control
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access (monitor DeviceNet IO only)	Register	40265:bit7
	Access Rule	Get

Auto RegMode	**Param Number**	**132**
Initialized to 'Auto RegMode NV' on reset/startup. Write 0 = No Change, remains 1-6 1 = Voltage 2 = Current 3 = Power 4 = Resistance 5 = Analog Feedback% 6 = Open Loop Write 7+ = No Change, remains 1-6 This allows the Reg Mode to be changed on the fly, but 'Auto RegMode NV' is reloaded on reset/powerup. NOTE: All Modes available with Phase Firing. With ZF or ZFT firing modes, 1-5 result in power linear control with input voltage compensation. And 6 is percentage firing control without line voltage compensation.	Access Rule	Get / Set
	Data Type	USINT
	Object Mapping	65_{hex}-1-4
	Group	Control
	Units	None
	Minimum Value	0
	Maximum Value	6
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40005
	Access Rule	Get / Set

Net Setpoint%	**Param Number**	**133**
If 'NetRef 'and 'RefFromNet' = 1, then this is the setpoint command for SCR control. (Otherwise, 'Analog Setpoint%' is the default setpoint if not overridden by 'Local Setpoint%'.) Normal setpoint range is 0-100.00%, or 0-10000 (ignoring user display decimal placement). The maximum value of 12500 allows an over-range input.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-5
	Group	Control
	Units	%
	Minimum Value	0.00
	Maximum Value	125.00
	Default Value	0.00
	Nonvolatile	No
Modbus Serial Port Access (monitor DeviceNet IO only)	Register	40045
	Access Rule	Get

DAC Out1 Ref	**Param Number**	**134**
Digital setpoint for analog output 1. Only applicable if 'DAC Out1 Select' = "10".	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-17
	Group	Control
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40008
	Access Rule	Get / Set

DAC Out2 Ref	**Param Number**	**135**
Digital setpoint for analog output 1. Only applicable if 'DAC Out2 Select' = "10".	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-18
	Group	Control
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40009
	Access Rule	Get / Set

DAC Out3 Ref	**Param Number**	**136**
Digital setpoint for analog output 1. Only applicable if 'DAC Out3 Select' = "10".	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-19
	Group	Control
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40010
	Access Rule	Get / Set

6.13 Metering Group

Iin Actual Peak%	**Param Number**	**1**
Actual input peak current as a percent of full load.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-20
	Group	Metering
	Units	%
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40011
	Access Rule	Get

Iin Actual RMS	**Param Number**	**2**
Actual input current.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-21
	Group	Metering
	Units	A
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40012
	Access Rule	Get

Iin Actual RMS%	**Param Number**	**3**
Actual input current as a percent of full load.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-22
	Group	Metering
	Units	%
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40013
	Access Rule	Get

Vin Actual RMS	**Param Number**	**4**
Actual input voltage.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-23
	Group	Metering
	Units	V
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40014
	Access Rule	Get

Vin Actual RMS%	**Param Number**	**5**
Actual input voltage as a percent of full load.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-24
	Group	Metering
	Units	%
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40015
	Access Rule	Get

KVAin Actual	**Param Number**	**6**
Actual input KVA.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-25
	Group	Metering
	Units	KVA
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40016
	Access Rule	Get

KVAin Actual%	**Param Number**	**7**
Actual input KVA as a percent of full load.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-26
	Group	Metering
	Units	%
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40017
	Access Rule	Get

Iout Actual RMS	**Param Number**	**8**
Actual output current. Iout Actual RMS is a function of 'Iout Actual RMS%' and 'Iout_XFMR_Ratng'.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-27
	Group	Metering
	Units	A
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40018
	Access Rule	Get

Iout Actual RMS%	**Param Number**	**9**
Actual output current as a percent of full load. If 'Current_XFMR_Cnt' = 1, Iout is calculated using data from the same CT as Iin. However, 'Iout_CAL_ZERO' and 'Iout_CAL_SPAN' are still independently applied. If 'Current_XFMR_Cnt' = 2, the second CT is used for Iout measurements.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-28
	Group	Metering
	Units	%
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40019
	Access Rule	Get

Vout Actual RMS	**Param Number**	**10**
Actual output voltage.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-29
	Group	Metering
	Units	V
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40020
	Access Rule	Get

Vout Actual RMS%	**Param Number**	**11**
Actual output voltage as a percent of full load.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-30
	Group	Metering
	Units	%
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40021
	Access Rule	Get

KWout Actual	**Param Number**	**12**
Actual output KW.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-31
	Group	Metering
	Units	KW
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40022
	Access Rule	Get

KWout Actual%	**Param Number**	**13**
Actual output KW as a percent of full load.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-32
	Group	Metering
	Units	%
	Minimum Value	0.0
	Maximum Value	6553.5
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40023
	Access Rule	Get

Ambient Temp C	**Param Number**	**14**
Inside ambient temperature measured on the DSP processor board.	Access Rule	Get
	Data Type	INT
	Object Mapping	65_{hex}-1-33
	Group	Metering
	Units	°C
	Minimum Value	-40
	Maximum Value	125
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40024
	Access Rule	Get

Frequency Actual	**Param Number**	**15**
AC input frequency to the SCRs.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-34
	Group	Metering
	Units	Hz
	Minimum Value	0.0
	Maximum Value	70.0
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40025
	Access Rule	Get

Nom Input Freq	**Param Number**	**16**
Nominal AC input frequency to the SCRs. Set to 50.0 or 60.0. This is only used for the frequency deviation alarm comparisons. It is not used to operate the SCRs. It is automatically set to 50 or 60 by checking if the input frequency is greater or less than 55.0 Hz.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-35
	Group	Metering
	Units	Hz
	Minimum Value	50.0
	Maximum Value	60.0
	Default Value	60.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40026
	Access Rule	Get

Power Factor	**Param Number**	**17**
During PF-phase fire mode: PF = KW_OUT/KVA_IN During zero fire modes: Fixed at 1.00.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-36
	Group	Metering
	Units	None
	Minimum Value	0.00
	Maximum Value	1.00
	Default Value	0.00
	Nonvolatile	No
Modbus Serial Port Access	Register	40027
	Access Rule	Get

Resistance Ratio	**Param Number**	**18**
Load Resistance ratio. Not valid if Vout<10%. Resistance Ratio = (%Volts / %Amps) x 100 Examples: 1%V / 100%A * 100 = 1 100%V / 100%A * 100 = 100 100%V / 1%A * 100 = 10000	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-37
	Group	Metering
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40028
	Access Rule	Get

Conductance%	**Param Number**	**20**
Conductance = f((Iout/Vout) x SCRdutycycle) Calibrated to equal 100.0% (1000) at 100% Iout and 100% Vout at 100% duty cycle (full on). This value is undefined and equals 0 when the unit is using ZF or ZFT firing mode.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-39
	Group	Metering
	Units	None
	Minimum Value	0.0
	Maximum Value	100.0
	Default Value	0.0
	Nonvolatile	No
Modbus Serial Port Access	Register	40030
	Access Rule	Get

Analog Setpoint%	**Param Number**	**218**
'ADC_Setpt_Zero' and 'ADC_Setpt_Span' are typically applied to 'ADC_Setpoint_Raw' to result in a setpoint range of 0-10000. If 'ADC_Setpt_Zero' > 0, a negative setpoint may result (treated as zero for regulation purposes). 'ADC_Setpt_Span' is available to adjust the gain of the value. In a typical calibration with a 2-10V (4-20 mA/500ohm) command setpoint, 'Analog Setpoint%' will range from about –2000 to 10000, when the input is changed from 0V to 10V. When displayed with a decimal point, this appears as –20.00% to 100.00%.	Access Rule	Get
	Data Type	INT
	Object Mapping	65_{hex}-1-221
	Group	Metering
	Units	%
	Minimum Value	-327.68
	Maximum Value	327.67
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40168
	Access Rule	Get

Analog Feedback%	**Param Number**	**222**
'ADC_Feedbck_Zero' and 'ADC_ Feedbck _Span' are typically applied to 'ADC_ Feedbck _Raw' to result in a range of 0-10000. If 'ADC_ Feedbck _Zero' > 0, a negative setpoint may result (treated as zero for regulation purposes). 'ADC_ Feedbck _Span' is available to adjust the gain of the value. In a typical calibration with a 2-10V (4-20 mA/500ohm) command setpoint, 'Analog Setpoint%' will range from about –2000 to 10000, when the input is changed from 0V to 10V. When displayed with a decimal point, this appears as –20.00% to 100.00%.	Access Rule	Get
	Data Type	INT
	Object Mapping	65_{hex}-1-225
	Group	Metering
	Units	%
	Minimum Value	-327.68
	Maximum Value	327.67
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40172
	Access Rule	Get

6.14 Monitor Parameters Group

Status Auxiliary	**Param Number**	**19**
One WORD containing 16 BOOL alarm/status flags. Bit 0 = Vin RMS High Bit 1 = Vin RMS Low Bit 2 = Iin Peak Fault Bit 3 = Iin Timed OL Bit 4 = Heatsink Overtemp Bit 5 = SCR Short/OutOpen Bit 6 = SCR Short/w Amps Bit 7 = Frequency Deviation Bit 8 = High Ambient Bit 9 = Fuse Switch Out Bit 10 = Load Res High (Vout>10%) Bit 11 = Load Res Low (Vout>10%) Bit 12 = Reserved12 Bit 13 = Reserved13 Bit 14 = Opt Intern Input Bit 15 = External Fault	Access Rule	Get
	Data Type	WORD
	Object Mapping	65_{hex}-1-38
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access 40003:bit00 or Coil 33 = Vin RMS High 40003:bit01 or Coil 34 = Vin RMS Low 40003:bit02 or Coil 35 = Iin Peak Fault 40003:bit03 or Coil 36 = Iin Timed OL 40003:bit04 or Coil 37 = Heatsink Overtemp 40003:bit05 or Coil 38 = SCR Short/OutOpen 40003:bit06 or Coil 39 = SCR Short/w Amps 40003:bit07 or Coil 40 = Frequency Deviation 40003:bit08 or Coil 41 = High Ambient 40003:bit09 or Coil 42 = Fuse Switch Out 40003:bit10 or Coil 43 = Load Res High 40003:bit11 or Coil 44 = Load Res Low 40003:bit12 or Coil 45 = Reserved12 40003:bit13 or Coil 46 = Reserved13 40003:bit14 or Coil 47 = Opt Intern Input 40003:bit15 or Coil 48 = External Fault	Register Or Coils	40003 00033-00048
	Access Rule	Get

The table on the following page lists the conditions that will set each bit in Status Auxiliary.

Table 22 Status Auxiliary Bit Control Conditions

Status Auxiliary: Bit Name	**Conditions that will control or set each bit.** Parameter names in **BOLD** are used to configure an alarm setpoint.
Vin RMS High	'Vin Actual RMS%' > **'Iin High%'**
Vin RMS Low	'Vin Actual RMS%' < **'Iin Low%'**
Iin Peak Fault	(Disabled if 'Iin PeakFault%' = 0) If 'Iin Actual Peak' > **'Iin PeakFault%'** for 2 cycles, then the SCR control resets and forces the output to walk up from zero. Each PeakFault reset is counted internally. If the count exceeds **'Iin Peak Retry'** within the time set by **'Iin Peak Timer',** then this flag is set. This alarm must be enabled in the 'Fault Mask' or unlimited resets are possible. This flag is reset the same a the 'Faulted' alarm, even if the unit is not faulted.
Iin Timed OL	'Iin Actual RMS%' > **'Iin RMS OL%'** continuously for a time greater than **'Iin RMS OL Timer'**.
Heatsink OT	Direct Discrete Input.
SCRShort/OutOpen	SCR control not running, but 'Vout Actual RMS%' > 75% for 4 seconds. This may be caused by a shorted SCR, but is more likely to be an open output (no load connected). The RC snubber in parallel with the SCRs always conducts a small amount of current.
SCR Short/w Amps	SCR control not running, but 'Iout Actual RMS%' > 5% for 4 seconds. Anomalous condition requiring investigation to determine cause of measured current when SCR gates are off.
Freq Deviation	|'Frequency Actual' - 'Nom Input Freq'| > **'Freq Deviation'**. 'Nom Input Freq' is automatically set to 50.0 or 60.0 when the SCR AC input is available.
High Ambient	'Ambient Temp C' > **'Ambient OT Limit'**.
Fuse Switch Out	Direct Discrete Input.
Load Res High	'Resistance Ratio' > **'Res Ratio High'** AND 'Vout Actual RMS%' > 10%.
Load Res Low	'Resistance Ratio' < **'Res Ratio Low'** AND 'Vout Actual RMS%' > 10%.
--Factory--	
--Factory--	
Optional Intern Input	Direct Discrete Input. (Internal use only)(not used)
External Fault	Direct Discrete Input.

Faulted	**Param Number**	**152**
Summary of all latching faults 0 = Not Faulted 1 = Faulted, Latched	Access Rule	Get
	Data Type	BOOL
	Object Mapping	$8D_{hex}$-1-10
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit0 00017
	Access Rule	Get

Warning	**Param Number**	**153**
Summary of all warnings 0 = No Warning 1 = Warning Warning will be true if an input condition is true AND the condition is enabled using 'Warning Mask'.	Access Rule	Get
	Data Type	BOOL
	Object Mapping	$8D_{hex}$-1-11
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit1 00018
	Access Rule	Get

Running1	**Param Number**	**154**
0 = Gates Disabled. 1 = Gates Enabled Enabling requires Enable Output discrete active, no Fault, SCR AC available, and Run command.	Access Rule	Get
	Data Type	BOOL
	Object Mapping	$8D_{hex}$-1-7
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit2 00019
	Access Rule	Get

SCR AC In Status	**Param Number**	**155**
0 = AC to SCR input not qualified to run. 1 = AC to SCR input is qualified to run. Voltage in must be above 50% of nominal and within 46-64 Hz.	Access Rule	Get
	Data Type	BOOL
	Object Mapping	65_{hex}-1-6
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit3 00020
	Access Rule	Get

Ready	**Param Number**	**156**
0 = SCR AC Input NOT Available, OR discrete Enable Output off, OR faulted. 1 = SCR AC Input available AND discrete Enable Output on AND no faults	Access Rule	Get
	Data Type	BOOL
	Object Mapping	$8D_{hex}$-1-9
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit4 00021
	Access Rule	Get

CtrlFromNet	**Param Number**	**157**
0 = Run1 does not control unit 1 = Run1 controls unit This acknowledges a NetCtrl request from master. ‘Run1’ controls Run/Stop when CtrlFromNet is true.	Access Rule	Get
	Data Type	BOOL
	Object Mapping	$8D_{hex}$-1-15
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit5 00022
	Access Rule	Get

RefFromNet	**Param Number**	**158**
0 = Reference (setpoint) not from net. 1 = Reference from DeviceNet master. This acknowledges a NetRef request from master, if allowed. ‘Net_Setpoint’ provides the setpoint when RefFromNet is true.	Access Rule	Get
	Data Type	BOOL
	Object Mapping	65_{hex}-1-2
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit6 00023
	Access Rule	Get

At Setpoint	**Param Number**	**159**
0 = Regulation not at Setpoint 1 = At Setpoint (+/- 1%) If 'Max Duty Cycle' = 1 (SCRs full on), or the output is limiting in PF, phase fire mode, the output cannot reach the desired setpoint.	Access Rule	Get
	Data Type	BOOL
	Object Mapping	65_{hex}-1-3
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit7 00024
	Access Rule	Get

CtrlFromLocal	**Param Number**	**160**
0 = No local Run/Stop control from the local digital port. Run/Stop control based on AutoRun or network control. 1 = Local manual control based on 'Local Run1' This is a confirmation flag. 'LocalCtrl' has highest control priority, so this will be true if 'LocalCtrl' is true.	Access Rule	Get
	Data Type	BOOL
	Object Mapping	65_{hex}-1-7
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit8 00025
	Access Rule	Get

RefFromLocal	**Param Number**	**161**
0 = Setpoint source is Analog or from network 1 = 'Local_Setpoint' is the controller setpoint input. This is a confirmation flag. 'LocalRef Demand' has highest control priority, so this will be true if 'LocalRef Demand' is true.	Access Rule	Get
	Data Type	BOOL
	Object Mapping	65_{hex}-1-8
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit9 00026
	Access Rule	Get

RefFromAnalog	**Param Number**	**162**
0 = Setpoint is not from analog input. 1 = Setpoint is currently from analog input. Setpoint is from analog unless 'RefFromNet' or 'Ref From Local' selects another reference.	Access Rule	Get
	Data Type	BOOL
	Object Mapping	65_{hex}-1-9
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit10 00027
	Access Rule	Get

Relay State	**Param Number**	**163**
0 = Relay is not activated 1 = Relay is activated Relay may or may not be energized based on logic configured in 'Invert Discretes'.	Access Rule	Get
	Data Type	BOOL
	Object Mapping	65_{hex}-1-15
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit11 00028
	Access Rule	Get

Enable Output	**Param Number**	**164**
0 = Discrete Enable Output is inactive. 1 = Discrete Enable Output is active.	Access Rule	Get
	Data Type	BOOL
	Object Mapping	65_{hex}-1-16
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit12 00029
	Access Rule	Get

Max Duty Cycle 0 = Not limiting 1 = SCR duty cycle is at maximum duty cycle. The SCR gate drive output is at 100%.	**Param Number**	**165**
	Access Rule	Get
	Data Type	BOOL
	Object Mapping	65_{hex}-1-11
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit13 00030
	Access Rule	Get

Summary Limiting 0 = No PID Limiting 1 = Iin OR Iout OR Vout OR Power Output is limiting. Limiting only affects SCR control in PF-phase fire mode. This is only a monitoring flag in other modes.	**Param Number**	**166**
	Access Rule	Get
	Data Type	BOOL
	Object Mapping	65_{hex}-1-10
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit14 00031
	Access Rule	Get

INPUT1 Discrete Discrete input with programmable polarity. 0 = Not active. 1 = Active. The function of this discrete input is programmable. This can be used as a network discrete input or as an input to the Relay, Fault masks, or PFZF control.	**Param Number**	**167**
	Access Rule	Get
	Data Type	BOOL
	Object Mapping	65_{hex}-1-139
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register or Coil	40002:bit15 00032
	Access Rule	Get

Limit Bit Status	**Param Number**	**168**
If the output is limited in PF-phase fire mode, these flags identify the specific limiting source. Bit 00 = Iin Limiting Bit 01 = Iout Limiting Bit 02 = Vout Limiting Bit 03 = KWout Limiting Bit 04 = Reserved4 Bit 05 = Reserved5 Bit 06 = Reserved6 Bit 07 = Reserved7 Bit 08 = Reserved8 Bit 09 = Reserved9 Bit 10 = Reserved10 Bit 11 = Reserved11 Bit 12 = Reserved12 Bit 13 = Reserved13 Bit 14 = Reserved14 Bit 15 = Reserved15	Access Rule	Get
	Data Type	WORD
	Object Mapping	65_{hex}-1-40
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access 40004:bit00 or Coil 49 = Iin Limiting 40004:bit01 or Coil 50 = Iout Limiting 40004:bit02 or Coil 51 = Vout Limiting 40004:bit03 or Coil 52 = KWout Limiting	Register or Coil	40004:bit0-bit3 00049-00051
	Access Rule	Get

Internal Exc	**Param Number**	**169**
Internal exception is one input that may generate a warning. It is a combination of possible internal conditions that may be monitored. Bit 0 = Int24VdcLow, 0=OK, 1=LOW Bit 1 = Reserved1 Bit 2 = Reserved2 Bit 3 = Reserved3 Bit 4 = Reserved4 Bit 5 = Reserved5 Bit 6 = Reserved6 Bit 7 = Reserved7 Bit 8 = Reserved8 Bit 9 = Reserved9 Bit 10 = Reserved10 Bit 11 = Reserved11 Bit 12 = Reserved12 Bit 13 = Reserved13 Bit 14 = Reserved14 Bit 15 = Reserved15	Access Rule	Get
	Data Type	WORD
	Object Mapping	$8D_{hex}$-1-100
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40031
	Access Rule	Get

Warning Status	**Param Number**	**170**
The condition(s) causing Warning to be true can be monitored with these flags. The flag is only true if the condition is true AND it is enabled in 'Warning Mask'. Bit 0 = Comm Fault Bit 1 = Comm Idle Bit 2 = High Ambient Bit 3 = SCRShort/OutOpen Bit 4 = Vin RMS High Bit 5 = Vin RMS Low Bit 6 = Summary Limiting Bit 7 = Frequency Deviation Bit 8 = Iin Timed OL Bit 9 = SCR Short/w Amps Bit 10 = Load Res High (Vout>10%) Bit 11 = Load Res Low (Vout>10%) Bit 12 = Fuse Switch Out Bit 13 = Max Duty Cycle Bit 14 = Internal Exc Bit 15 = Reserved15	Access Rule	Get
	Data Type	WORD
	Object Mapping	$8D_{hex}$-1-101
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40032
	Access Rule	Get

Fault Status	**Param Number**	**171**
The condition(s) causing a faulted condition can be monitored with these flags. The flag is only true if the condition is true AND it is enabled in 'Fault Mask'. Bit 0 = INPUT1 Bit 1 = Heatsink OT Bit 2 = High Ambient Bit 3 = SCRShort/OutOpen Bit 4 = Vin RMS High Bit 5 = Vin RMS Low Bit 6 = Reserved6 Bit 7 = Iin Peak Fault (latched-nonblocking) Bit 8 = Iin Timed OL (latched-nonblocking) Bit 9 = Watchdog Tripped Bit 10 = Reserved10 Bit 11 = Comm Fault (DeviceNet) Bit 12 = Comm Idle (DeviceNet) Bit 13 = Warning Bit 14 = External Fault Bit 15 = Reserved15 NOTE: A faulted condition may not be reset if any enabled fault condition still exists. Existing fault conditions that will block a reset attempt can be determined by checking this parameter. Bit7 and Bit8 are special cases. They latch to preserve the historical event, but will not prevent a reset. They will also be reset when a faulted condition is reset.	Access Rule	Get
	Data Type	WORD
	Object Mapping	$8D_{hex}$-1-102
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40033
	Access Rule	Get

Relay Status	**Param Number**	**172**
The condition(s) causing relay activation can be monitored with these flags. The flag is only true if the condition is true AND it is enabled in 'Relay Mask'. Bit 0 = INPUT1 Bit 1 = Heatsink OT Bit 2 = High Ambient Bit 3 = SCRShort/OutOpen Bit 4 = Vin RMS High Bit 5 = Vin RMS Low Bit 6 = Warning Bit 7 = Frequency Deviation Bit 8 = Fault Bit 9 = SCR Short/w Amps Bit 10 = Load Res High Bit 11 = Load Res Low Bit 12 = Fuse Switch Out Bit 13 = Local Relay Req Bit 14 = Remote Relay Req (DeviceNet) Bit 15 = Reserved15	Access Rule	Get
	Data Type	WORD
	Object Mapping	$8D_{hex}$-1-103
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40034
	Access Rule	Get

WarnCode	**Param Number**	**173**
If in Warning state, WarnCode indicates the event that caused the transition to Warning state. If multiple events occurred simultaneously, the lowest code value is displayed. If not in Warning state, WarnCode indicates the event that caused the last transition to the Warning state, since power-up. Power-up state is 15. 0 WARNCODE Comm Fault 1 WARNCODE Comm Idle 2 WARNCODE High Ambient 3 WARNCODE SCRShort/OutOpen 4 WARNCODE Vin RMS High 5 WARNCODE Vin RMS Low 6 WARNCODE Summary Limiting 7 WARNCODE Frequency Deviation 8 WARNCODE Iin Timed OL 9 WARNCODE SCR Short/wAmps 10 WARNCODE Load Res High 11 WARNCODE Load Res Low 12 WARNCODE Fuse Switch Out 13 WARNCODE Max Voltage Out 14 WARNCODE Internal Exception 15 WARNCODE None	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-107
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	15
	Default Value	15
	Nonvolatile	No
Modbus Serial Port Access	Register	40035
	Access Rule	Get

FaultCode	**Param Number**	**174**
If in Faulted state, FaultCode indicates the event that caused the transition to Faulted state. If multiple events occurred simultaneously, the lowest code value is displayed. If not in faulted state, FaultCode indicates the event that caused the last transition to the Faulted state, since power-up. Power-up state is 15. 0 FAULTCODE INPUT 1 FAULTCODE Heatsink OT 2 FAULTCODE High Ambient 3 FAULTCODE SCRShort/OutOpen 4 FAULTCODE Vin RMS High 5 FAULTCODE Vin RMS Low 6 FAULTCODE Reserved6 7 FAULTCODE IinPeakFault 8 FAULTCODE IinTimedOL 9 FAULTCODE Reserved9 10 FAULTCODE Reserved10 11 FAULTCODE Comm Fault 12 FAULTCODE Comm Idle 13 FAULTCODE Warning 14 FAULTCODE External Fault 15 FAULTCODE None	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-108
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	15
	Default Value	15
	Nonvolatile	No
Modbus Serial Port Access	Register	40036
	Access Rule	Get

RelayCode	**Param Number**	**175**
If in RelayActive state, RelayCode indicates the event that caused the transition to RelayActive state. If multiple events occurred simultaneously, the lowest code value is displayed. If not in RelayActive state, RelayCode indicates the event that caused the last transition to the RelayActive state, since power-up. Power-up state is 15. 0 RELAYCODE INPUT1 1 RELAYCODE Heatsink OT 2 RELAYCODE High Ambient 3 RELAYCODE SCRShort/OutOpen 4 RELAYCODE Vin RMS High 5 RELAYCODE Vin RMS Low 6 RELAYCODE Warning 7 RELAYCODE Frequency Deviation 8 RELAYCODE Fault 9 RELAYCODE SCR Short/wAmps 10 RELAYCODE Load Res High 11 RELAYCODE Load Res Low 12 RELAYCODE Fuse Switch Out 13 RELAYCODE Local Relay Req 14 RELAYCODE Remote Relay Req 15 RELAYCODE None	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-109
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	15
	Default Value	15
	Nonvolatile	No
Modbus Serial Port Access	Register	40037
	Access Rule	Get

Setpoint Actual%	**Param Number**	**176**
The value currently driving regulation after applying ramp up/down limits. The regulation setpoint may come from analog input value, network provided value, or local digital value.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-41
	Group	Monitor Param
	Units	%
	Minimum Value	0.00
	Maximum Value	655.35
	Default Value	0.00
	Nonvolatile	No
Modbus Serial Port Access	Register	40038
	Access Rule	Get

Reg Mode Actual	**Param Number**	**177**
Lists the regulation mode that is actually in use. 1 = Voltage 2 = Current 3 = Power 4 = Resistance 5 = Analog Feedback% 6 = Open Loop NOTE: All Modes available with Phase Firing. With ZF or ZFT firing modes, 1-5 result in power linear control with input voltage compensation. And 6 is percentage firing control without line voltage compensation.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-42
	Group	Monitor Param
	Units	None
	Minimum Value	1
	Maximum Value	6
	Default Value	1
	Nonvolatile	No
Modbus Serial Port Access	Register	40039
	Access Rule	Get

DutyCycle Actual	**Param Number**	**178**
0 = off. 100.00% = full on.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-43
	Group	Monitor Param
	Units	None
	Minimum Value	0.00
	Maximum Value	100.00
	Default Value	0.00
	Nonvolatile	No
Modbus Serial Port Access	Register	40040
	Access Rule	Get

DAC Out1 Actual	**Param Number**	**179**
Actual output data driving the analog driver 1.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-44
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40041
	Access Rule	Get

DAC Out2 Actual	**Param Number**	**180**
Actual output data driving the analog driver2.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-45
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40042
	Access Rule	Get

DAC Out3 Actual	**Param Number**	**181**
Actual output data driving the analog driver3.	Access Rule	Get
	Data Type	BOOL
	Object Mapping	65_{hex}-1-46
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40043
	Access Rule	Get

FiringModeActual	**Param Number**	**182**
0 = Zero Fire, Var Timebase 1 = Phase Fire 2 = ZFT Zero Fire into Transformer 3 = PF via PFZF Select, using PFZF mode 4 = ZF via PFZF Select, using PFZF mode 5 = PF via INPUT1, using PFZF mode 6 = ZF via INPUT1, using PFZF mode 7 = PF via PFZF Time Delay, using PFZF mode 8 = ZF via PFZF Time Delay, using PFZF mode	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-47
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	8
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40044
	Access Rule	Get

Local Setpoint%	**Param Number**	**183**
This is the controlling setpoint only when enabled using 'LocalRef_Demand' Local Setpt NV determines Reset/Startup value. ***For Devicenet, 'Local Setpoint%' is a monitoring parameter. For the local Modbus ports, it is a control parameter. See the Modbus Only Control section for details	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-48
	Group	Monitor Param
	Units	%
	Minimum Value	0.00
	Maximum Value	125.00
	Default Value	0.00
	Nonvolatile	No
Modbus Serial Port Access	Register	***40007
	Access Rule	Get / Set

Local RegMode	**Param Number**	**184**
This regulation mode will be used if 'Local Ref Demand' = 1. 0 = Use Existing 'Auto RegMode' 1 = Voltage 2 = Current 3 = Power 4 = Resistance 5 = Analog Feedback% 6 = Open Loop Local Setpt NV determines Reset/Startup value selection. ***For Devicenet, 'Local RegMode' is a monitoring parameter. For the local Modbus ports, it is a control parameter. See the Modbus Only Control section for details	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-49
	Group	Monitor Param
	Units	None
	Minimum Value	0
	Maximum Value	6
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	***40006
	Access Rule	Get / Set

6.15 Timers Group

Control Time On, *Output Time On*, and *KW-hour Meter* are UDINT (32-bit) timers. To facilitate different forms of data access, they are mapped as both UDINT and UINT (16-bit) values.

DeviceNet – For DeviceNet explicit messaging, the UDINT form is best for direct transfer and display of the value. The UINT versions are available so that the timer values may be mapped into the programmable assembly objects by parameter number reference using *AssyWord0 Param - AssyWord10 Param*.

Modbus – The 16-bit versions are also mapped for Modbus access via the local serial ports. These are in consecutive Register addresses so that they may be accessed using 32-bit HMI programming commands, when available.

Control Time On	**Param Number**	**143**
Total time that control power has been applied. 0.001 hour resolution. Ticks every 3.6 seconds when powered.	Access Rule	Get
	Data Type	UDINT
	Object Mapping	65_{hex}-1-50
	Group	Timers
	Units	Hr
	Minimum Value	0.000
	Maximum Value	4294967.295
	Default Value	0.000
	Nonvolatile	Yes
Modbus Serial Port Access	Register	None
	Access Rule	Get

Control Time Lsb	**Param Number**	**144**
Least significant 16-bits of Parameter 143. Only use this version when the number must be passed as two 16-bit numbers and reassembled into a 32-bit value.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-51
	Group	Timers
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	-
Modbus Serial Port Access	Register	40046
	Access Rule	Get

Control Time Msb	**Param Number**	**145**
Most significant 16-bits of Parameter 143. Only use this version when the number must be passed as two 16-bit numbers and reassembled into a 32-bit value.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-52
	Group	Timers
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	-
Modbus Serial Port Access	Register	40047
	Access Rule	Get

Output Time On	**Param Number**	**146**
Total time that controller has been running. 0.001 hour resolution. Ticks every 3.6 seconds when running.	Access Rule	Get
	Data Type	UDINT
	Object Mapping	65_{hex}-1-53
	Group	Timers
	Units	Hr
	Minimum Value	0.000
	Maximum Value	4294967.295
	Default Value	0.000
	Nonvolatile	Yes
Modbus Serial Port Access	Register	None
	Access Rule	Get

Output Time Lsb	**Param Number**	**147**
Least significant 16-bits of Parameter 146. Only use this version when the number must be passed as two 16-bit numbers and reassembled into a 32-bit value.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-54
	Group	Timers
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	-
Modbus Serial Port Access	Register	40048
	Access Rule	Get

Output Time Msb	**Param Number**	**148**
Most significant 16-bits of Parameter 146. Only use this version when the number must be passed as two 16-bit numbers and reassembled into a 32-bit value.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-55
	Group	Timers
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	-
Modbus Serial Port Access	Register	40049
	Access Rule	Get

KW-hour Meter	**Param Number**	**149**
KW-hour Meter. 0.1 KW-hour resolution.	Access Rule	Get
	Data Type	UDINT
	Object Mapping	65_{hex}-1-56
	Group	Timers
	Units	KWH
	Minimum Value	0.0
	Maximum Value	429496729.5
	Default Value	0.0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	None
	Access Rule	Get

KW-hour Lsb	**Param Number**	**150**
Least significant 16-bits of Parameter 149. Only use this version when the number must be passed as two 16-bit numbers and reassembled into a 32-bit value.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-57
	Group	Timers
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	-
Modbus Serial Port Access	Register	40050
	Access Rule	Get

KW-hour Msb	**Param Number**	**151**
Most significant 16-bits of Parameter 149. Only use this version when the number must be passed as two 16-bit numbers and reassembled into a 32-bit value.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-58
	Group	Timers
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	-
Modbus Serial Port Access	Register	40051
	Access Rule	Get

6.16 Event Log Group

Log Config	**Param Number**	**82**
Configuration value to specify the range of events to be placed in the log. 0 = Only log controller events 1 = Also log DeviceNet events	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-120
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	1
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40068
	Access Rule	Get / Set

Log Count	**Param Number**	**83**
Number of Entries recorded into log. Circular log rolls over when full and overwrites oldest logs. Log Count rolls over to zero after maximum count.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-121
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40052
	Access Rule	Get

Log Last ID	**Param Number**	**84**
Most recent log entry ID used. The log ID is a sequential number to label a log. It may be used to view data recorded in past logs by entering the ID number in 'Log View ID REQ' when using the log viewer. ID rolls over to zero after maximum value is used.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-122
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40053
	Access Rule	Get

Log Last T Lsb	**Param Number**	**85**
Least significant 16-bits of Parameter 193, the 32-bit timestamp. Only use this version when the number must be passed as two 16-bit numbers and reassembled into a 32-bit value.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-124
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40054
	Access Rule	Get

Log Last T Msb	**Param Number**	**86**
Most significant 16-bits of Parameter 193, the 32-bit timestamp. Only use this version when the number must be passed as two 16-bit numbers and reassembled into a 32-bit value.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-125
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40055
	Access Rule	Get

Log Last Event	**Param Number**	**87**
Most recent log entry event code.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-126
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40056
	Access Rule	Get

Log Last Data1	**Param Number**	**88**
Most recent “Data1” entry for last log event.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-127
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40057
	Access Rule	Get

Log Last Data2	**Param Number**	**89**
Most recent “Data2” entry for last log event.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-128
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40058
	Access Rule	Get

Log Last Data3	**Param Number**	**90**
Most recent “Data3” entry for last log event.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-129
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40059
	Access Rule	Get

Log View ID REQ	**Param Number**	**91**
Enter Log ID # here to retrieve log data into Viewer ID, Viewer Timestamp, and Viewer Code. Number should be less than the Log Count. The Log is a circular nonvolatile memory. Requesting a future ID value, or a long past value that exceeds the memory size, will access whatever log entry currently stored in the specified location.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-130
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40060
	Access Rule	Get / Set

Log View ID	**Param Number**	**92**
Log ID of log retrieved from memory based on requested log using ‘Log View ID REQ’. After retrieving a past log from memory for viewing, the ‘Log View ID’ will match the ‘Log View ID REQ’ value requested by the user.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-131
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40061
	Access Rule	Get

Log View T Lsb	**Param Number**	**93**
Least significant 16-bits of Parameter 194, the 32-bit timestamp. Only use this version when the number must be passed as two 16-bit numbers and reassembled into a 32-bit value.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-133
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40062
	Access Rule	Get

Log View T Msb	**Param Number**	**94**
Most significant 16-bits of Parameter 194, the 32-bit timestamp. Only use this version when the number must be passed as two 16-bit numbers and reassembled into a 32-bit value.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-134
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40063
	Access Rule	Get

Log View Event	**Param Number**	**95**
Displays event code of log requested in 'Log View ID REQ'.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-135
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40064
	Access Rule	Get

Log View Data1	**Param Number**	**96**
Displays Data1 of log requested in Log View ID REQ. Data definition depends on event code.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-136
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40065
	Access Rule	Get

Log View Data2	**Param Number**	**97**
Displays Data2 of log requested in Log View ID REQ. Data definition depends on event code.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-137
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40066
	Access Rule	Get

Log View Data3	**Param Number**	**98**
Displays Data3 of log requested in Log View ID REQ. Data definition depends on event code.	Access Rule	Get
	Data Type	UINT
	Object Mapping	$8D_{hex}$-1-138
	Group	Event Log
	Units	-
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40067
	Access Rule	Get

Log Last Time	**Param Number**	**193**
This is the timestamp of the last log recorded. The current value of 'Control Time On' is used as a 32-bit timestamp for each log entry. This provides 3.6 second resolution for log time entries. This number is also accessible as 16-bit UINT values (Lsb+Msb). See Parameters 85/86.	Access Rule	Get
	Data Type	UDINT
	Object Mapping	$8D_{hex}$-1-123
	Group	Event Log
	Units	Hr
	Minimum Value	0.000
	Maximum Value	4294967.295
	Default Value	0.000
	Nonvolatile	No
Modbus Serial Port Access	Register	None
	Access Rule	Get

Log View Time	**Param Number**	**194**
This is the timestamp of the log requested using 'Log View ID REQ'. The current value of 'Control Time On' was used as a 32-bit timestamp for each log recorded. This provides 3.6 second resolution for log time entries. This number is also accessible as 16-bit UINT values (Lsb+Msb). See Parameters 93/94.	Access Rule	Get
	Data Type	UDINT
	Object Mapping	$8D_{hex}$-1-132
	Group	Event Log
	Units	Hr
	Minimum Value	0.000
	Maximum Value	4294967.295
	Default Value	0.000
	Nonvolatile	No
Modbus Serial Port Access	Register	None
	Access Rule	Get

6.17 A/B Serial Ports Group

Modbus A Addr	**Param Number**	**99**
Address of RS-232 Modbus port. Changes only take affect on reset/powerup.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-113
	Group	Modbus
	Units	None
	Minimum Value	1
	Maximum Value	247
	Default Value	1
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40125
	Access Rule	Get / Set

ABaud Rate	**Param Number**	**100**
Baud rate of RS-232 Modbus port. Changes only take affect on reset/powerup. 0 = 2400 1 = 4800 2 = 9600 3 = 19200	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-114
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	3
	Default Value	3
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40126
	Access Rule	Get / Set

AParity/StopBits	**Param Number**	**101**
Parity/StopBits of RS-232 Modbus port. Changes only take affect on reset/powerup. 0 = None + 2 stop bits, 1 = Odd + 1 stop bit, 2 = Even + 1 stop bit.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-115
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	2
	Default Value	2
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40127
	Access Rule	Get / Set

Modbus B Addr	**Param Number**	**102**
Address of RS-485 Modbus port. Changes only take affect on reset/powerup.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-116
	Group	Modbus
	Units	None
	Minimum Value	1
	Maximum Value	247
	Default Value	1
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40128
	Access Rule	Get / Set

BBaud Rate	**Param Number**	**103**
Baud rate of RS-485 Modbus port. Changes only take affect on reset/powerup. 0 = 2400 1 = 4800 2 = 9600 3 = 19200	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-117
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	3
	Default Value	3
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40129
	Access Rule	Get / Set

BParity/StopBits	**Param Number**	**104**
Parity/StopBits of RS-485 Modbus port. Changes only take affect on reset/powerup. 0 = None + 2 stop bits, 1 = Odd + 1 stop bit, 2 = Even + 1 stop bit.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-118
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	2
	Default Value	2
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40130
	Access Rule	Get / Set

ARtnBusMsgCt	**Param Number**	**105**
A - RS232 - Return Bus Message Count – Diagnostic Counter. Quantity of messages that the remote device has detected on the communications system since its last restart or power–up. Messages with bad CRC are not taken into account.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-127
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40186
	Access Rule	Get

ARtnBusComErrCt	**Param Number**	**106**
A - RS232 - Return Bus Communication Error Count – Diagnostic Counter. Quantity of CRC errors encountered by the remote device since its last restart or power–up. In case of an error detected on the character level, (overrun, parity error), or in case of a message length < 3 bytes, the receiving device is not able to calculate the CRC. In such cases, this counter is also incremented.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-128
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40187
	Access Rule	Get

ARtnSlaveExErrCt	**Param Number**	**107**
A - RS232 - Return Slave Exception Error Count – Diagnostic Counter. Quantity of MODBUS exception error detected by the remote device since its last restart or power–up. It comprises also the error detected in broadcast messages even if an exception message is not returned in this case.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-129
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40188
	Access Rule	Get

ARtnSlaveMsgCt	**Param Number**	**108**
A - RS232 - Return Slave Message Count – Diagnostic Counter. Quantity of messages addressed to the remote device, including broadcast messages that the remote device has processed since its last restart or power–up.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-130
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40189
	Access Rule	Get

ARtnSlaveNoRspCt	**Param Number**	**109**
A - RS232 - Return Slave No Response Count – Diagnostic Counter. Quantity of messages received by the remote device for which it returned no response (neither a normal response nor an exception response), since its last restart or power–up. Then, this counter counts the number of broadcast messages it has received.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-131
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40190
	Access Rule	Get

AbuffOverflowCt	**Param Number**	**110**
A - RS232 -Incoming 256 byte buffer overflow – Diagnostic Counter. Quantity of messages received by the remote device with a packet length exceeding the input buffer, since its last restart, or power–up.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-132
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40191
	Access Rule	Get

BRtnBusMsgCt	**Param Number**	**111**
B – RS485 - Return Bus Message Count – Diagnostic Counter. Quantity of messages that the remote device has detected on the communications system since its last restart or power–up. Messages with bad CRC are not taken into account.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-133
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40192
	Access Rule	Get

BRtnBusComErrCt	**Param Number**	**112**
B – RS485 - Return Bus Communication Error Count – Diagnostic Counter. Quantity of CRC errors encountered by the remote device since its last restart or power–up. In case of an error detected on the character level, (overrun, parity error), or in case of a message length < 3 bytes, the receiving device is not able to calculate the CRC. In such cases, this counter is also incremented.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-134
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40193
	Access Rule	Get

BRtnSlaveExErrCt	**Param Number**	**113**
B – RS485 - Return Slave Exception Error Count – Diagnostic Counter. Quantity of MODBUS exception error detected by the remote device since its last restart or power–up. It comprises also the error detected in broadcast messages even if an exception message is not returned in this case.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-135
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40194
	Access Rule	Get

BRtnSlaveMsgCt	**Param Number**	**114**
B – RS485 - Return Slave Message Count – Diagnostic Counter. Quantity of messages addressed to the remote device, including broadcast messages that the remote device has processed since its last restart or power–up.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-136
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40195
	Access Rule	Get

BRtnSlaveNoRspCt	**Param Number**	**115**
B – RS485 - Return Slave No Response Count – Diagnostic Counter. Quantity of messages received by the remote device for which it returned no response (neither a normal response nor an exception response), since its last restart or power–up. Then, this counter counts the number of broadcast messages it has received.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-137
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40196
	Access Rule	Get

BbuffOverflowCt	**Param Number**	**116**
B – RS485 -Incoming 256 byte buffer overflow – Diagnostic Counter. Quantity of messages received by the remote device with a packet length exceeding the input buffer, since its last restart, or power–up.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-138
	Group	Modbus
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40197
	Access Rule	Get

6.18 **Calibration Group**

VinRMS Unscaled	**Param Number**	**197**
Voltage input unscaled RMS measurement The nominal value is 10000 at 100.00% voltage using the HDR 3400531 voltage potential transformer when the applied primary voltage equals the voltage tap rating.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-200
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40147
	Access Rule	Get

Vin CAL ZERO	**Param Number**	**198**
Voltage input zero calibration value. This value is subtracted from 'VinRMS Unscaled' before 'Vin CAL SPAN' is applied.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-201
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	100 rev1.001 200 rev2.001
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40148
	Access Rule	Get / Set

Vin CAL SPAN	**Param Number**	**199**
Voltage input span calibration value. Parameter 5, 'Vin Actual RMS%' = ('VinRMS Unscaled' - 'Vin CAL ZERO') x ('Vin CAL SPAN'/4095). Note that the span adjustment equals ('Vin CAL SPAN'/4095), therefore a value of 4095 for 'Vin CAL SPAN' provides unity span adjustment (4095/4095=1). The min and max values limit span adjustment to X/2 (2047/4095) to 2X (8190/4095).	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-202
	Group	Calibration
	Units	None
	Minimum Value	2047
	Maximum Value	8190
	Default Value	4095
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40149
	Access Rule	Get / Set

Parameter 5, 'Vin Actual RMS%' from the Metering group, may also be included in the Calibration group as a monitored value when adjusting zero and span.
Parameter 4, 'Vin Actual RMS' from the Metering group, is useful if you wish to monitor the value in scaled engineering units.

VoutRMS Unscaled	**Param Number**	**200**
Voltage output unscaled RMS measurement. The nominal value is 10000 at 100.00% voltage using the HDR 3400531 voltage potential transformer when the applied primary voltage equals the voltage tap rating.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-203
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40150
	Access Rule	Get

Vout CAL ZERO	**Param Number**	**201**
Voltage output zero calibration value. This value is subtracted from 'VoutRMS Unscaled' before 'Vout CAL SPAN' is applied.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-204
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	100 rev1.001 200 rev2.001
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40151
	Access Rule	Get / Set

Vout CAL SPAN	**Param Number**	**202**
Voltage output span calibration value. Parameter 11, 'Vout Actual RMS%' = ('VoutRMS Unscaled' - 'Vout CAL ZERO') x ('Vout CAL SPAN'/4095). Note that the span adjustment equals ('Vout CAL SPAN'/4095), therefore a value of 4095 for 'Vout CAL SPAN' provides unity span adjustment (4095/4095=1). The min and max values limit span adjustment to X/2 (2047/4095) to 2X (8190/4095).	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-205
	Group	Calibration
	Units	None
	Minimum Value	2047
	Maximum Value	8190
	Default Value	4095
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40152
	Access Rule	Get / Set

Parameter 11, 'Vout Actual RMS%' from the Metering group, may also be included in the Calibration group as a monitored value when adjusting zero and span.
Parameter 10, 'Vout Actual RMS' from the Metering group, is useful if you wish to monitor the value in scaled engineering units.

IinRMS Unscaled	**Param Number**	**203**
Current input unscaled RMS measurement. The nominal value is 10000 at 100.00% current using a standard 5A current transformer.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-206
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40153
	Access Rule	Get

Iin CAL ZERO	**Param Number**	**204**
Current input zero calibration value. This value is subtracted from 'IinRMS Unscaled' before 'Iin CAL SPAN' is applied.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-207
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	100 rev1.001 200 rev2.001
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40154
	Access Rule	Get / Set

Iin CAL SPAN	**Param Number**	**205**
Current input span calibration value. Parameter 3, 'Iin Actual RMS%' = ('IinRMS Unscaled' - 'Iin CAL ZERO') x ('Iin CAL SPAN'/4095). Note that the span adjustment equals ('Iin CAL SPAN'/4095), therefore a value of 4095 for 'Iin CAL SPAN' provides unity span adjustment (4095/4095=1). The min and max values limit span adjustment to X/2 (2047/4095) to 2X (8190/4095).	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-208
	Group	Calibration
	Units	None
	Minimum Value	2047
	Maximum Value	8190
	Default Value	4095
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40155
	Access Rule	Get / Set

Parameter 3, 'Iin Actual RMS%' from the Metering group, may also be included in the Calibration group as a monitored value when adjusting zero and span.
Parameter 2, 'Iin Actual RMS' from the Metering group, is useful if you wish to monitor the value in scaled engineering units.

IoutRMS Unscaled	**Param Number**	**206**
Current output unscaled RMS measurement. The nominal value is 10000 at 100.00% current using a standard 5A current transformer.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-209
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40156
	Access Rule	Get

Iout CAL ZERO	**Param Number**	**207**
Current output zero calibration value. This value is subtracted from 'IoutRMS Unscaled' before 'Iout CAL SPAN' is applied.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-210
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	100 rev1.001 200 rev2.001
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40157
	Access Rule	Get / Set

Iout CAL SPAN	**Param Number**	**208**
Current output span calibration value. Parameter 9, 'Iout Actual RMS%' = ('IoutRMS Unscaled' - 'Iout CAL ZERO') x ('Iout CAL SPAN'/4095). Note that the span adjustment equals ('Iout CAL SPAN'/4095), therefore a value of 4095 for 'Iout CAL SPAN' provides unity span adjustment (4095/4095=1). The min and max values limit span adjustment to X/2 (2047/4095) to 2X (8190/4095).	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-211
	Group	Calibration
	Units	None
	Minimum Value	2047
	Maximum Value	8190
	Default Value	4095
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40158
	Access Rule	Get / Set

Parameter 9, 'Iout Actual RMS%' from the Metering group, may also be included in the Calibration group as a monitored value when adjusting zero and span.
Parameter 8, 'Iout Actual RMS' from the Metering group, is useful if you wish to monitor the value in scaled engineering units.

KWout Unscaled	**Param Number**	**209**
KW output unscaled measurement. The nominal value is 10000 at 100.00% power.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-212
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40159
	Access Rule	Get

KWout CAL ZERO	**Param Number**	**210**
KW output zero calibration value. This value is subtracted from 'KWout Unscaled' before 'KWout CAL SPAN' is applied.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-213
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	100 rev1.001 200 rev2.001
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40160
	Access Rule	Get / Set

KWout CAL SPAN	**Param Number**	**211**
KW output span calibration value. Parameter 13, 'KWout Actual%' = ('KWout Unscaled' - 'KWout CAL ZERO') x ('KWout CAL SPAN'/4095). Note that the span adjustment equals ('KWout CAL SPAN'/4095), therefore a value of 4095 for 'KWout CAL SPAN' provides unity span adjustment (4095/4095=1). The min and max values limit span adjustment to X/2 (2047/4095) to 2X (8190/4095).	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-214
	Group	Calibration
	Units	None
	Minimum Value	2047
	Maximum Value	8190
	Default Value	4095
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40161
	Access Rule	Get / Set

Parameter 13, 'KWout Actual%' from the Metering group, may also be included in the Calibration group as a monitored value when adjusting zero and span.
Parameter 12, 'KWout Actual' from the Metering group, is useful if you wish to monitor the value in scaled engineering units.

Conduct Unscaled	**Param Number**	**212**
Load conductance unscaled measurement. This is a regulation feedback signal used for resistance regulation. The nominal value is 10000 when the controller is operating full on (100% duty cycle) with 100% current and 100% voltage output.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-215
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	None
	Nonvolatile	No
Modbus Serial Port Access	Register	40162
	Access Rule	Get

Conduct CAL ZERO	**Param Number**	**213**
Load Conductance zero calibration value. This value is subtracted from 'Conduct Unscaled' before 'Conduct CAL SPAN' is applied.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-216
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	100 rev1.001 200 rev2.001
	Default Value	0
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40163
	Access Rule	Get / Set

Conduct CAL SPAN	**Param Number**	**214**
Load Conductance span calibration value. Parameter 20, 'Conductance%' = ('Conduct Unscaled' - 'Conduct CAL ZERO') x ('Conduct CAL SPAN'/4095). Note that the span adjustment equals ('Conduct CAL SPAN'/4095), therefore a value of 4095 for 'Conduct CAL SPAN' provides unity span adjustment (4095/4095=1). The min and max values limit span adjustment to X/2 (2047/4095) to 2X (8190/4095).	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-217
	Group	Calibration
	Units	None
	Minimum Value	2047
	Maximum Value	8190
	Default Value	4095
	Nonvolatile	Yes
Calibration Serial Port Access	Register	40164
	Access Rule	Get / Set

Parameter 20, 'Conductance%' from the Metering group, may also be included in the Calibration group as a monitored value when adjusting zero and span.

ADC Setpoint Raw	**Param Number**	**215**
Direct ADC reading of Command Setpoint input. The nominal value is 12000 under these conditions. 'ADC Setpt Zero' = 0. 'ADC Setpt Span' = 4095. An input of 10V (20 mA @ 500 ohms) is applied to the input. The expectation is that the zero will most likely be set to approximately 2000 (20.00%) to operate with a 2-10V (4-20 mA) input.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-218
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40165
	Access Rule	Get

ADC Setpt Zero	**Param Number**	**216**
Analog command setpoint zero calibration value. This value is subtracted from 'ADC Setpoint Raw before 'ADC Setpt Span' is applied. The default value of 2000 assumes that a 2-10V (4-20 mA) is a likely input.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-219
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	10000
	Default Value	2500
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40166
	Access Rule	Get / Set

ADC Setpt Span	**Param Number**	**217**
Analog command setpoint span calibration value. Parameter 218, 'Analog Setpoint%' = ('ADC Setpoint Raw - 'ADC Setpt Zero) x ('ADC Setpt Span'/4095). Note that the span adjustment equals ('ADC Setpt Span/4095), therefore a value of 4095 for 'ADC Setpt Span' provides unity span adjustment (4095/4095=1). The min and max values limit span adjustment to 0.2 (819/4095) to 5X (20475/4095).	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-220
	Group	Calibration
	Units	None
	Minimum Value	819
	Maximum Value	20475 rev1.001 10237 rev2.001
	Default Value	4095
	Nonvolatile	Yes
Calibration Serial Port Access	Register	40167
	Access Rule	Get / Set

Parameter 218, 'Analog Setpoint%' from the Metering group, may also be included in the Calibration group as a monitored value when adjusting zero and span.

ADC Feedbck Raw	**Param Number**	**219**
Direct ADC reading of feedback input. The nominal value is 12000 under these conditions. 'ADC Feedbck Zero' = 0. 'ADC Feedbck Span' = 4095. An input of 10V (20 mA @ 500 ohms) is applied to the input. The expectation is that the zero will most likely be set to approximately 2000 (20.00%) to operate with a 2-10V (4-20 mA) input.	Access Rule	Get
	Data Type	UINT
	Object Mapping	65_{hex}-1-222
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	65535
	Default Value	0
	Nonvolatile	No
Modbus Serial Port Access	Register	40169
	Access Rule	Get

ADC Feedbck Zero	**Param Number**	**220**
Analog feedback zero calibration value. This value is subtracted from 'ADC Setpoint Raw before 'ADC Feedbck Span' is applied. The default value of 2000 assumes that a 2-10V (4-20 mA) is a likely input.	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-223
	Group	Calibration
	Units	None
	Minimum Value	0
	Maximum Value	10000
	Default Value	2500
	Nonvolatile	Yes
Modbus Serial Port Access	Register	40170
	Access Rule	Get / Set

ADC Feedbck Span	**Param Number**	**221**
Analog feedback span calibration value. Parameter 222, 'Analog Feedback%' = ('ADC Setpoint Raw - 'ADC Feedbck Zero) x ('ADC Feedbck Span'/4095). Note that the span adjustment equals ('ADC Feedbck Span/4095), therefore a value of 4095 for 'ADC Feedbck Span' provides unity span adjustment (4095/4095=1). The min and max values limit span adjustment to 0.2 (819/4095) to 5X (20475/4095).	Access Rule	Get / Set
	Data Type	UINT
	Object Mapping	65_{hex}-1-224
	Group	Calibration
	Units	None
	Minimum Value	819
	Maximum Value	20475 rev1.001 10237 rev2.001
	Default Value	4095
	Nonvolatile	Yes
Calibration Serial Port Access	Register	40171
	Access Rule	Get / Set

Parameter 222, 'Analog Feedback%' from the Metering group, may also be included in the Calibration group as a monitored value when adjusting zero and span.

7 SCR CONTROL SUPERVISOR OBJECT

7.1 Introduction

SCR Control Supervisor Object, Class Code: $8D_{hex}$ (141)

SCR Control Supervisor Object, Class Code: $8D_{hex}$ (141) is a "vendor specific" object and not part of the "Hierarchy of Motor Control Devices".

The SCR Control Supervisor Object is modeled after, and is very similar to, the Control Supervisor Object, Class Code: 29_{hex} (41), in ODVA's THE CIP NETWORKS LIBRARY.Volume 1, Common Industrial Protocol (CIP™) specification.

The behavior of the SCR controller is described by the State Transition Diagram and the Run/Stop Event Matrix.

The class attributes, instance attributes, and common services are listed in the appendix.

The most notable difference from the Control Supervisor Object, Class Code: 29_{hex} is that the default values of *NetFaultMode* and *NetIdleMode* are not zero. In most application, the SCR controller must be operational before DeviceNet establishes a connection, and must continue to run if the network connection is lost. The critical continuity of electrical power is typically maintained by either falling back to a self-contained mode using a local analog control setpoint and discrete input point control, or local manual control by the equipment operator.

7.2 NetFaultMode Attribute

Loss of application control and/or critical process diagnostic data may result if network communication is disrupted. Detecting communication faults and taking appropriate action can minimize potential issues. For the SCR Control Supervisor, a DeviceNet Comm Fault is defined as the lack of any network connection.

Attribute $8D_{hex}$-1-16, *NetFaultMode* is defined slightly differently than the Control Supervisor Object, Class Code: 29_{hex} (41) used within the "Hierarchy of Motor Control Devices". The NetFaultMode attribute establishes the mode of operation on loss of network communication.

The possible values for this attribute are:

0 = Fault and Stop, Fault bit automatically set in *Fault Mask*. The *Fault Mask* bit is automatically set and cleared based on the value of *NetFaultMode*. DO NOT use this setting if you must maintain furnace heat under all conditions. Clears *NetCtrl*, *NetRef*, *Run1*, *Remote Relay Req*, *Net PFZF Select,* and *Net_Setpoint*.

1 = (default) Ignore (Warning optional depending on bit setting in *Warning Mask*). This will allow the controller to continue in existing operation mode at time of network event.

If running with network run/stop or setpoint reference control, the last value of *Run1* and/or *NetRef* will continue. *Run1*, *Remote Relay Req*, *Net PFZF Select*, *Net Setpoint%* are unchanged. CAUTION: This will essentially freeze important controls until manual control can be taken over by a local operator.

DO USE this setting if DeviceNet is only used to monitor operation and automatic operations are to continue normally with, or without, network monitoring.

2 = If running with network run/stop or setpoint reference control, clears *NetCtrl*, *NetRef*, *Run1*, *Remote Relay Req*, *Net PFZF Select,* and *Net_Setpoint*. Does not trigger a fault. Resulting operation will depend on internal/local control fallback configuration. (Warning optional).

7.3 NetIdleMode Attribute

Ladder programs are suspended and networks go into idle state when a programmable controller is placed into program mode. This is not likely an issue if the network is only monitoring data. In some control applications, the user may want to specify alternative actions for the SCR controller to take if an idle condition is detected.

Attribute $8D_{hex}$-1-20, *NetIdleMode* is also defined slightly differently than the Control Supervisor Object, Class Code: 29_{hex} (41) used within the "Hierarchy of Motor Control Devices". The NetIdleMode attribute establishes the mode of operation on reception of network Idle communication. An idle message will be received if the network controller that the MP1 Controller is communicating to is placed to program mode.

The possible values for this attribute are:

0 = Fault and Stop, Fault bit automatically set in *Fault Mask*. The *Fault Mask* bit is automatically set and cleared based on the value of *NetIdleMode*. DO NOT use this setting if you must maintain furnace heat under all conditions. Clears *NetCtrl*, *NetRef*, *Run1*, *Remote Relay Req*, *Net PFZF Select,* and *Net_Setpoint*.

1 = (default) Ignore (Warning optional depending on bit setting in *Warning Mask*). This will allow the controller to continue in existing operation mode at time of network event.

If running with network run/stop or setpoint reference control, the last value of *Run1* and/or *NetRef* will continue. *Run1*, *Remote Relay Req*, *Net PFZF Select*, *Net Setpoint%* are unchanged. CAUTION: This will essentially freeze important controls until manual control can be taken over by a local operator. Consider using other settings.

DO USE this setting if DeviceNet is only used to monitor operation and automatic operations are to continue normally with, or without, network monitoring.

2 = If running with network run/stop or setpoint reference control, clears *NetCtrl*, *NetRef*, *Run1*, *Remote Relay Req*, *Net PFZF Select,* and *Net_Setpoint*. Does not trigger a fault. Resulting operation will depend on internal/local control fallback configuration. (Warning optional).

7.4 Behavior

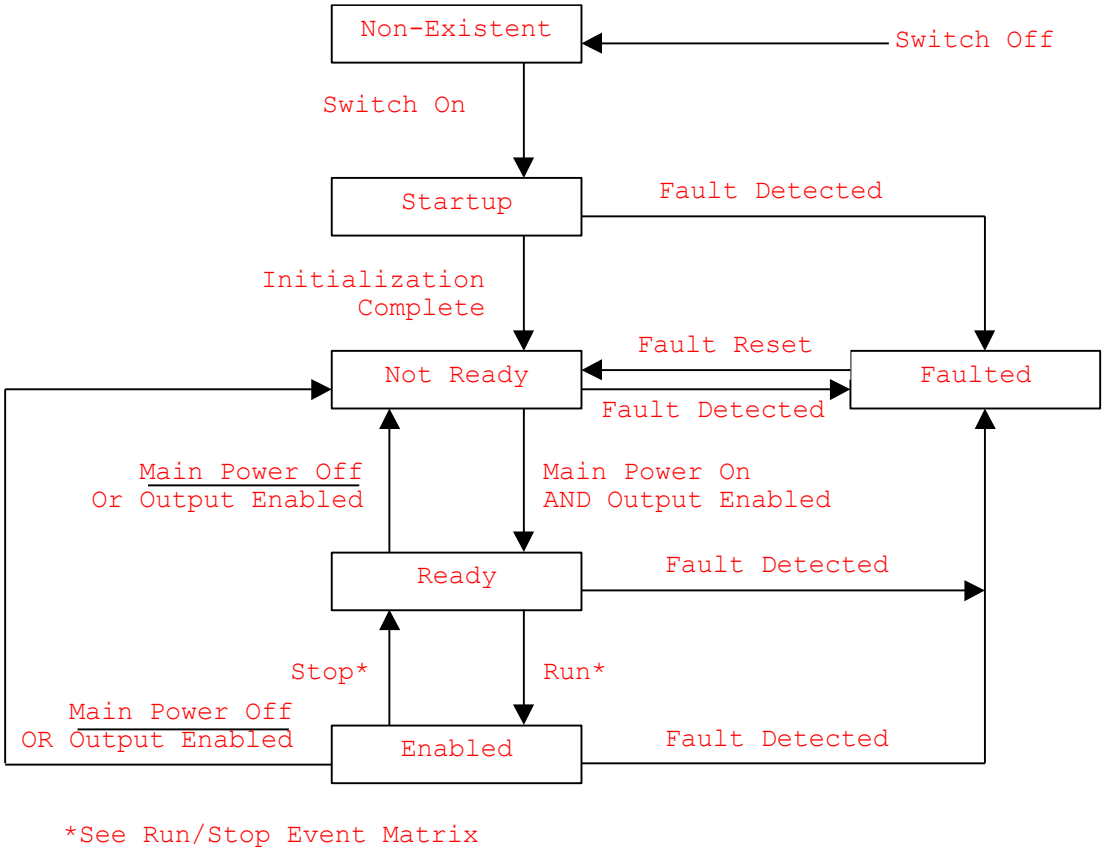


Figure 37 SCR Control Supervisor Behavior

7.5 Run/Stop Event Matrix

The unit may be controlled by local discrete signals (contacts or low voltage input), or by a local control panel or computer connected to Modbus serial ports, or by DeviceNet.

If digital control is not used, or is only used for data monitoring, the Run/Stop behavior will be controlled by discrete signals. If digital communication is used for Run/Stop control, the discrete inputs serve as local alarming and non-alarming

lockouts.

Attribute $8D_{hex}$-1-5, *NetCtrl* is used to request that Run/Stop events be controlled from the network. The device however, has the option of inhibiting Run/Stop events from the network, as the application may not allow Run/Stop control from the network under certain circumstances (when the local digital control panel overrides).
.
Only when attribute $8D_{hex}$-1-15, *CtrlFromNet* is set to 1 by the device in response to a *NetCtrl* request, is Run/Stop control actually controlled from the network. If attribute 15, *CtrlFromNet* is 1, the Run/Stop events are triggered by the *Run1* attribute as shown in the following table.

Similar attributes, <LocalCtrl>, <CtrlFromLocal> and <Local Run1>, are used by local digital control (local HMI panel) and inhibits *CntlFromNet*. Absent network or local digital control, Run/Stop is controlled by an internally configured parameter *AutoRun*.

<LocalCtrl> has higher priority than *NetCtrl*. If <LocalCtrl> = 0 and *NetCtrl* = 0, *AutoRun* determines if the unit is running (if Ready = 1).

'Ready = 1' requires that a) the unit is not in a faulted (tripped) condition, b) the local discrete input ENABLE OUTPUT is true, c) AC power is available at the SCR input, and d) internal 24 V dc is at normal level. In all cases the local discrete input ENABLE OUTPUT serves as a non-alarming lockout. It may also be used as a local RUN/STOP control when applications are controlled by discrete signals.

Table 23 Run/Stop Event Matrix

CtrlFromLocal (Response to LocalCtrl)	CtrlFromNet (Response to NetCtrl)	AutoRun (Nonvolatile & configurable)		Run1 (DeviceNet)	Local Run1 (Modbus)	Ready	Running1
0	0	0		NA	NA	1	0
0	0	1		NA	NA	1	1
0	1	NA		0	NA	1	0
0	1	NA		1	NA	1	1
1	0	NA		NA	0	1	0
1	0	NA		NA	1	1	1
NA	NA	NA		NA	NA	0	0

7.6 Fault Reset

Parameter 152, *Faulted,* is a latched flag that will maintain the unit in a tripped condition. (A faulted condition is also indicated using Modbus Coil 00017, <*Faulted*>, and the front panel FAULTED LED.)

- A fault may be reset using several methods:
- Send a "1" to Parameter 125, *FaultRst,*
- Send a "1" to Coil 00001, <Local Fault Rst>,

- Send service code 05hex, RESET, to the SCR Control Supervisor Object,
- Send a "1" to Modbus Coil 00008, <Reset SCR Contrl>,
- Switch the discrete input ENABLE OUTPUT to the off position (this must then be turned back on to return the unit to a ready state),
- Remove all control power and reapply power to reboot the controller.

CAUTION: The cause of a faulted condition is application specific. DO NOT automatically reset a unit unless you confirm and remove the cause of the fault, or the cause is self-clearing when load voltage is removed. Resetting a fault will again make the unit ready to run. If the issue causing the fault is not corrected, restoring power my be hazardous to equipment and personnel.

IMPORTANT

FaultRst, <Local Fault Rst>, *and <Reset SCR Contrl>* provide momentary reset action when the data transitions from 0->1. Once the reset action is triggered, they automatically clear. They will not remain at 1 and prevent another fault. They also cannot reset a fault if the cause of the fault is still active.

7.7 Warning, Fault, and Relay Codes

Attribute $8D_{hex}$-1-107, *WarnCode*, $8D_{hex}$-1-107, *FaultCode*, and $8D_{hex}$-1-107, *RelayCode*, store the cause of the last event triggering a warning, fault, or relay activation. These codes are saved after the event ends while the unit is powered. Refer to the section for Monitoring Parameters for details.

These codes are unique from the Event Log codes and are limited to 0-15 to assist HMI message displays. The codes definitions correspond to the bits in *Warning Mask*, *Fault Mask*, and *Relay Mask*.

7.8 Event Log

The event log stores over 200 entries in nonvolatile memory.

Each event is logged with the following information.

- 16-bit ID counter labels the event
- 32-bit TIMESTAMP, copies *Control Time On* (3.6 second resolution)
- 16-bit EVENT code classifying the event
- 16-bit DATA1, optional supplemental data captured at time of event
- 16-bit DATA2, optional supplemental data captured at time of event
- 16-bit DATA3, optional supplemental data captured at time of event

A circular nonvolatile event log memory records significant events. Each event includes an ID number, a timestamp, an event code, and up to three optional data items that provides additional information about the event.

Attribute $8D_{hex}$-1-120, *Log Config*, configures what data to log. The default configuration records only controller events. Optionally, DeviceNet network events may also be logged as a diagnostic aid.

One set of log parameters automatically update with the most recent log recorded. A second set of parameters are used as a historical log viewer and can retrieve any log data based on the log ID number requested using Attribute $8D_{hex}$-1-130, *Log View ID REQ*.

The following tables lists event codes and the definition of any optional data included.

Table 24 Log Event Codes

Controller Log Event Descriptions	Log Event Code	Optional Data
MP_EVENT_CommFault	1	None
MP_EVENT_CommIdle	2	None
MP_EVENT_HighAmbient	3	None
MP_EVENT_VinRmsHigh	4	None
MP_EVENT_VinRmsLow	5	None
MP_EVENT_SummaryLimit	6	None
MP_EVENT_FrequencyDev	7	None
MP_EVENT_IinTimedOL	8	None
MP_EVENT_ScrShortAmps	9	None
MP_EVENT_LoadResHigh	10	None
MP_EVENT_LoadResLow	11	None
MP_EVENT_FuseSwitch	12	None
MP_EVENT_MaxVout	13	None
MP_EVENT_InternalExc	14	None
MP_EVENT_HeatsinkOT	15	None
MP_EVENT_ScrShortOutOpen	16	None
MP_EVENT_IinPeakFault	17	Data1=IinPeakPct measured Data2=IinPeakTripLevel configured for comparision

		Data3=peakTripCount, counts trips up to limit
MP_EVENT_ExtFault	18	
MP_EVENT_INPUT1	19	
MP_EVENT_LocalRelayReq	20	
MP_EVENT_NetRelayReq	21	
MP_EVENT_WarningAlarmGoingOn	22	
MP_EVENT_WarningAlarmGoingOff	23	
MP_EVENT_FaultAlarmGoingOn	24	
MP_EVENT_FaultAlarmGoingOff	25	
MP_EVENT_RelayGoingOn	26	
MP_EVENT_RelayGoingOff	27	
MP_EVENT_WatchdogReset	28	
MP_EVENT_PowerUpReset	29	
MP_EVENT_SW2_BootSetting FACTORY/SERVICE USE ONLY. DO NOT CHANGE SW2 OF THE CONTROL BOARD. Must remain at position 0 to run.	30	If SW2 is set from 1-7, its value is logged at power-up. Position 0 is standard and not logged. 1-7 positions may trigger special events. 8-F are not used. Position 1: No Action Position 2: No Action Position 3: No Action Position 4: No Action Position 5: No Action Position 6: No Action Position 7: Re-initialize nonvolatile memory with default configuration and calibration values.
MP_EVENT_Nonvolatile_Init	31	Nonvolatile memory has been loaded with initial configuration and calibration values.

Table 25 Optional DeviceNet Log Event Codes

DeviceNet Log Event Descriptions	Log Event Code	Optional Data
DNS_Event_ExpToEstablishedState - An explicit connection transitioned to the established state	128	Data1 = connection ID of the event
DNS_Event_ExpToDeleted - An explicit connection has been deleted	129	Data1 = connection ID of the event
DNS_Event_ExpToTimedOut - An explicit connection transitioned to the timed out state	130	Data1 = connection ID of the event
DNS_Event_IocnxEstablished - An I/O connection transitioned to the established state	131	Data1 = connection ID of the event
DNS_Event_IocnxDeleted - An I/O connection has been deleted	132	Data1 = connection ID of the event
DNS_Event_IocnxTimedOut - An I/O connection transitioned to the timed out state	133	Data1 = connection ID of the event
DNS_Event_PassedNetStateMachine - The device successfully passed the Network Access State Machine	134	Data1 = connection ID of the event
DNS_Event_CanErrorStatusChange - The Error status of the CAN Controller has changed	135	Data1 = 0-error status bit reset, or 1-error status bit set
DNS_Event_IO_ReceiveError - The transport layer has discarded a message because of an error in format (too long, fragmentation error, etc)	136	Data1 = connection ID of the event
Reserved	137	
Reserved	138	
DNS_IdyReset – Identity reset	139	Data1 = reset_no: the service No.of the reset request
DNS_Fault_DUP_MAC_ERROR	144	UnrecoverableFault-None
DNS_Fault_RX_QUEUE_OVERRUN	145	UnrecoverableFault-None
DNS_Fault_TX_QUEUE_OVERRUN	146	UnrecoverableFault-None
DNS_Fault_IO_SEND_ERROR	147	UnrecoverableFault-None
DNS_Fault_CAN_BUS_OFF	148	UnrecoverableFault-None
DNS_Fault_CAN_OVERRUN	149	UnrecoverableFault-None
DNS_Fault_DNS_RESET	150	UnrecoverableFault-None
DNS_Fault_DNS_BUS_SENSE_ERROR	151	UnrecoverableFault-None
DNS_Fault_DNS_SWITCH_ERROR	152	UnrecoverableFault-None

8 DEVICENET I/O ASSEMBLIES

8.1 Assembly Object – Class Code 0x04

The following Assembly Instances are implemented. Some of these assemblies are identical or similar to the "motor control hierarchy" of the DeviceNet specification, but are numbered as vendor specific assemblies. Other vendor specific assemblies have been added to allow the monitoring of the inputs, outputs, etc.

Output Assemblies

Table 26 Output Assembly Instance 102, 0x66: Basic Overload (DEFAULT)

(Identical to Basic Overload Output Assembly 2 from ODVA Overload Profile)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						FaultRst		

Table 27 Output Assembly Instance 103, 0x67: Cmd/Mode/Ref

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ForceFault Trip	NetRef	NetCtrl	Net PFZF Select	NetKW Hour Reset	FaultRst	Remote Relay Req	Run1
1	Auto RegMode* or 0							
2	Net Setpoint% (low byte)							
3	Net Setpoint% (high byte)							

* Note that if byte Auto RegMode = 0 = No Change to the Regulation Mode

Table 28 Output Assembly Instance 104, 0x68: Cmd/Mode/Ref and 3 DAC Out Data

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ForceFault Trip	NetRef	NetCtrl	Net PFZF Select	NetKW Hour Reset	FaultRst	Remote Relay Req	Run1
1	Auto RegMode* or 0							
2	Net Setpoint% (low byte)							
3	Net Setpoint% (high byte)							
4	DAC Out1 Ref (low byte)							
5	DAC Out1 Ref (high byte)							
6	DAC Out2 Ref (low byte)							
7	DAC Out2 Ref (high byte)							
8	DAC Out3 Ref (low byte)							
9	DAC Out3 Ref (high byte)							

* Note that if byte Auto RegMode = 0 = No Change to the Regulation Mode

Comments about Output Assembly Instance 103 and 104

1. Byte #0 is evaluated lsb to msb, so if you simultaneously send "1" to *FaultRst* and *ForceFault Trip*, *ForceFault Trip* will be last and the unit will be in a faulted condition.
2. If 0xFF (all ones) are sent to byte #0, all data for this byte will be ignored. This prevents some DeviceNet test software, or improper PLC program, from triggering I/O action when sending 0xFF. (**Output Assembly Instance 102** will accept 0xFF since only one bit is used.)
3. Byte #1 may be used to change the Auto RegMode at any time. Typically, the regulation mode will not be changing and a filler byte of all zeros should be used. A value of zero leaves the regulation mode unchanged.

The following table indicates the I/O Assembly Data Attribute mapping for Output Assemblies:

Table 29 Assembly Data Attribute Mapping for Output Assemblies

Data Component Name	Class		Instance Number	Attribute		
	Name	Number		Name	Number	Type
Run1	SCR Control Supervisor	$8D_{hex}$	1	Run1	3	BOOL
Remote Relay Req	SCR Controller	65_{hex}	1	Remote Relay Req	12	BOOL
FaultRst	SCR Control Supervisor	$8D_{hex}$	1	FaultRst	12	BOOL
NetKW Hour Reset	SCR Controller	65_{hex}	1	NetKW Hour Reset	13	BOOL
Net PFZF Select	SCR Controller	65_{hex}	1	Net PFZF Select	14	BOOL
NetCtrl	SCR Control Supervisor	$8D_{hex}$	1	NetCtrl	5	BOOL
NetRef	SCR Controller	65_{hex}	1	NetRef	1	BOOL
ForceFault Trip	SCR Control Supervisor	$8D_{hex}$	1	ForceFault Trip	17	BOOL
Auto RegMode	SCR Controller	65_{hex}	1	Auto RegMode	4	USINT
Net Setpoint%	SCR Controller	65_{hex}	1	Net Setpoint%	5	UINT
DAC Out1 Ref	SCR Controller	65_{hex}	1	DAC Out1 Ref	17	UINT
DAC Out2 Ref	SCR Controller	65_{hex}	1	DAC Out2 Ref	18	UINT
DAC Out3 Ref	SCR Controller	65_{hex}	1	DAC Out3 Ref	19	UINT

Input Assemblies

Table 30 Input Assembly Instance 151, 0x97: Extended Overload

(Identical to Extended Overload Input Assembly 51 from ODVA Overload Profile)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0							Warning	Faulted

Table 31 Input Assembly Instance 152, 0x98: Status & 3 Param Based Data (DEFAULT)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Setpoint	RefFrom Net	CtrlFrom Net	Ready	SCR AC In Status	Running1	Warning	Faulted
1	INPUT1 Discrete	Summary Limiting	Max Duty Cycle	Output Enable	Relay State	RefFrom Analog	RefFrom Local	CtrlFrom Local
2	*Value of parameter pointed to by AssyWord0 Param (Low Byte)							
3	*Value of parameter pointed to by AssyWord0 Param (High Byte)							
4	*Value of parameter pointed to by AssyWord1 Param (Low Byte)							
5	*Value of parameter pointed to by AssyWord1 Param (High Byte)							
6	*Value of parameter pointed to by AssyWord2 Param (Low Byte)							
7	*Value of parameter pointed to by AssyWord2 Param (High Byte)							

*** BOOL and USINT parameters are filled with leading zeros to fit two bytes. UDINT parameters have no defined result, but are all available as split UINT parameters.**

Table 32 Input Assembly Instance 153, 0x99: Status & 7 Param Based Data

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Setpoint	RefFrom Net	CtrlFrom Net	Ready	SCR AC In Status	Running1	Warning	Faulted
1	INPUT1 Discrete	Summary Limiting	Max Duty Cycle	Output Enable	Relay State	RefFrom Analog	RefFrom Local	CtrlFrom Local
2	*Value of parameter pointed to by AssyWord0 Param (Low Byte)							
3	*Value of parameter pointed to by AssyWord0 Param (High Byte)							
4	*Value of parameter pointed to by AssyWord1 Param (Low Byte)							
5	*Value of parameter pointed to by AssyWord1 Param (High Byte)							
6	*Value of parameter pointed to by AssyWord2 Param (Low Byte)							
7	*Value of parameter pointed to by AssyWord2 Param (High Byte)							
8	*Value of parameter pointed to by AssyWord3 Param (Low Byte)							
9	*Value of parameter pointed to by AssyWord3 Param (High Byte)							
10	*Value of parameter pointed to by AssyWord4 Param (Low Byte)							
11	*Value of parameter pointed to by AssyWord4 Param (High Byte)							
12	*Value of parameter pointed to by AssyWord5 Param (Low Byte)							
13	*Value of parameter pointed to by AssyWord5 Param (High Byte)							
14	*Value of parameter pointed to by AssyWord6 Param (Low Byte)							
15	*Value of parameter pointed to by AssyWord6 Param (High Byte)							

*** BOOL and USINT parameters are filled with leading zeros to fit two bytes. UDINT parameters have no defined result, but are all available as split UINT parameters.**

Table 33 Input Assembly Instance 154, 0x9A: Status & 11 Param Based Data

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Setpoint	RefFrom Net	CtrlFromNet	Ready	SCR AC In Status	Running 1	Warning	Faulted
1	INPUT1 Discrete	Summary Limiting	Max Duty Cycle	Output Enable	Relay State	RefFrom Analog	RefFrom Local	CtrlFrom Local
2	*Value of parameter pointed to by AssyWord0 Param (Low Byte)							
3	*Value of parameter pointed to by AssyWord0 Param (High Byte)							
4	*Value of parameter pointed to by AssyWord1 Param (Low Byte)							
5	*Value of parameter pointed to by AssyWord1 Param (High Byte)							
6	*Value of parameter pointed to by AssyWord2 Param (Low Byte)							
7	*Value of parameter pointed to by AssyWord2 Param (High Byte)							
8	*Value of parameter pointed to by AssyWord3 Param (Low Byte)							
9	*Value of parameter pointed to by AssyWord3 Param (High Byte)							
10	*Value of parameter pointed to by AssyWord4 Param (Low Byte)							
11	*Value of parameter pointed to by AssyWord4 Param (High Byte)							
12	*Value of parameter pointed to by AssyWord5 Param (Low Byte)							
13	*Value of parameter pointed to by AssyWord5 Param (High Byte)							
14	*Value of parameter pointed to by AssyWord6 Param (Low Byte)							
15	*Value of parameter pointed to by AssyWord6 Param (High Byte)							
16	*Value of parameter pointed to by AssyWord7 Param (Low Byte)							
17	*Value of parameter pointed to by AssyWord7 Param (High Byte)							
18	*Value of parameter pointed to by AssyWord8 Param (Low Byte)							
19	*Value of parameter pointed to by AssyWord8 Param (High Byte)							
20	*Value of parameter pointed to by AssyWord9 Param (Low Byte)							
21	*Value of parameter pointed to by AssyWord9 Param (High Byte)							
22	*Value of parameter pointed to by AssyWord10 Param (Low Byte)							
23	*Value of parameter pointed to by AssyWord10 Param (High Byte)							

*** BOOL and USINT parameters are filled with leading zeros to fit two bytes. UDINT parameters have no defined result, but are all available as split UINT parameters.**

The following table indicates the I/O Assembly Data Attribute mapping for Input Assemblies:

Table 34 Assembly Data Attribute Mapping for Input Assemblies

Data Component Name	Class		Instance Number	Attribute		
	Name	Number		Name	Number	Type
Faulted	SCR Control Supervisor	$8D_{hex}$	1	Faulted	10	BOOL
Warning	SCR Control Supervisor	$8D_{hex}$	1	Warning	11	BOOL
Running1	SCR Control Supervisor	$8D_{hex}$	1	Running1	7	BOOL
SCR AC In Status	SCR Controller	$A1_{hex}$	1	SCR AC In Status	6	BOOL
Ready	SCR Control Supervisor	$8D_{hex}$	1	Ready	9	BOOL
CtrlFromNet	SCR Control Supervisor	$8D_{hex}$	1	CtrlFromNet	15	BOOL
RefFromNet	SCR Controller	65_{hex}	1	RefFromNet	2	BOOL
At Setpoint	SCR Controller	65_{hex}	1	At Setpoint	3	BOOL
CtrlFromLocal	SCR Controller	65_{hex}	1	CtrlFromLocal	7	BOOL
RefFromLocal	SCR Controller	65_{hex}	1	RefFromLocal	8	BOOL
RefFromAnalog	SCR Controller	65_{hex}	1	RefFromAnalog	9	BOOL
Relay State	SCR Controller	65_{hex}	1	Relay State	15	BOOL
Output Enable	SCR Controller	65_{hex}	1	Output Enable	16	BOOL
Max Duty Cycle	SCR Controller	65_{hex}	1	Max Duty Cycle	11	BOOL
Summary Limiting	SCR Controller	65_{hex}	1	Summary Limiting	10	BOOL
INPUT1 Discrete	SCR Controller	65_{hex}	1	INPUT1 Discrete	139	BOOL

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9 MODBUS ONLY PARAMETERS

9.1 Introduction

Unless you are programming a Modbus HMI, Modbus PLC, or computer, you don't need to be concerned with these details. However, it does explain how the Modbus protocol is used to make the mini-HMI panel a nonvolatile manual control that can replace traditional switches and potentiometers.

The serial port Modbus implementation is intended primarily to support HDR's mini-HMI panels, which serve as powerful, yet very economical, control panels. They may also support computer programs or larger HMI implementations.

While the vast majority of configuration and monitoring parameters are equally available to DeviceNet and Modbus, there are some differences. These differences provide several benefits.

The Modbus parameters provide control arbitration such that communication via Modbus is considered a local control panel and has priority over DeviceNet when digital Run/Stop and Setpoint control is used.

The Modbus parameters and access functions are arranged to provide more efficient communication and compatibility with a variety of HMI panels allowing design flexibility for custom applications.

Nonvolatile manual controls are essential for SCR heating applications where furnaces must be operated even when all automated controls and networks are not functional. Some Modbus parameters include conditional nonvolatility. This allows a simple Modbus master to provide the benefits of discrete manual controls. This allow manual Run/Stop to be selected and a manually selected command setpoint to be set and recalled even if all power is removed and restored. This allow a digital control panel to replace discrete Auto/Manual switches and locking potentiometers for manual control.

9.2 Modbus I/O Coils and Registers

The first 4 Modbus Registers overlap the 64 Modbus Coils. This allows flexibility to access these 1-bit attributes using either Modbus Coil functions or Register functions. Single and multiple read/write functions are supported.

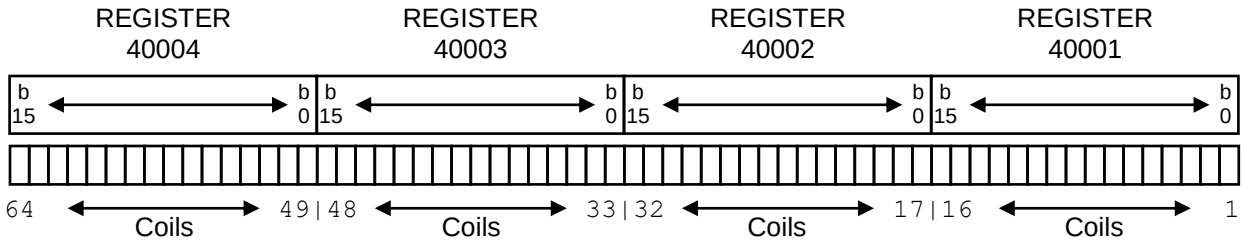

Figure 38 Map of Overlapping Modbus Coils and Registers

Table 35 Listing of Modbus Register Overlapping Coils

<Coils_1-16>	**Register Number**	**40001**
Register overlaps Coils 1-16.	Access Rule	Get / Set

<Coils_17-32>	**Register Number**	**40002**
Register overlaps Coils 17-32.	Access Rule	Get / Set

<Coils_33-48>	**Register Number**	**40003**
Register overlaps Coils 33-48.	Access Rule	Get / Set

<Coils_49-64>	**Register Number**	**40004**
Register overlaps Coils 49-64.	Access Rule	Get / Set

As already shown in the DeviceNet Parameter definitions, most parameters are available equally to both the network and Modbus ports.

Although Modbus has a separate set of control from DeviceNet, there is symmetry in the information and capability. The following table summarizes similarities and differences of Modbus Coils and Registers that are not identical to DeviceNet Parameters.

Table 36 Comparision of Select Modbus and DeviceNet Parameters.

<Local Fault Rst>	Local control, similar to *FaultRst.*
<LocalCtrl>	Local control, similar to *NetCtrl.*
<Local Run1>	Local control, similar to *Run1*.
<LocalRef Demand>	Local control, similar to *NetRef.*
<KW Hour Reset>	Local control, similar to *NetKW Hour Reset.*
<Local ForceFault>	Local control, similar to *ForceFault Trip.*
<Local Relay Req>	Local control, similar to *Remote Relay Req.*
<Reset SCR Contrl>	Local control, similar to RESET command to SCR Control Supervisor Object.
<Local Control NV>	Unique to local control to provide nonvolatile manual controls.
<Local Setpt NV>	Unique to local control to provide nonvolatile manual controls.
<Local PFZF Sel>	Local control, similar to *Net PFZF Select.*
<Faulted>	Same as *Faulted.*
<Warning>	Same as *Warning.*
<Running1>	Same as *Running.*
<SCR AC In Status>	Same as *SCR AC In Status.*
<Ready>	Same as *Ready.*
<CtrlFromNet>	Same as *CtrlFromNet.*
<RefFromNet>	Same as *RefFromNet.*
<At Setpoint>	Same as *At Setpoint.*
<CtrlFromLocal>	Same as *CtrlFromLocal.*
<RefFromLocal>	Same as *RefFromLocal.*
<RefFromAnalog>	Same as *RefFromAnalog.*
<Relay State>	Same as *Relay State.*
<Enable Output>	Same as *Enable Output.*
<Max Duty Cycle>	Same as *Max Duty Cycle.*
<Summary Limiting>	Same as *Summary Limiting.*
<INPUT1 Discrete>	Same as *INPUT1 Discrete.*
<Vin RMS High>	Same as Vin RMS High bit in *Status Auxiliary.*
<Vin RMS Low>	Same as Vin RMS Low bit in *Status Auxiliary.*
<Iin Peak Fault>	Same as Iin Peak Fault bit in *Status Auxiliary.*
<Iin Timed OL>	Same as Iin Timed OL bit in *Status Auxiliary.*
<Heatsink OT>	Same as Heatsink OT bit in *Status Auxiliary.*
<SCRShort/OutOpen>	Same as SCRShort/OutOpen bit in *Status Auxiliary.*
<SCR Short/w Amps>	Same as SCR Short/w Amps bit in *Status Auxiliary.*
<Freq Deviation>	Same as Freq Deviation bit in *Status Auxiliary.*
<High Ambient>	Same as High Ambient bit in *Status Auxiliary.*
<Fuse Switch Out>	Same as Fuse Switch Out bit in *Status Auxiliary.*
<Load Res High>	Same as Load Res High bit in *Status Auxiliary.*
<Load Res Low>	Same as Load Res Low bit in *Status Auxiliary.*
<Watchdog Tripped>	Same as Watchdog Tripped bit in *Status Auxiliary.*
<NV Cfg Checksum>	Same as NV Cfg Checksum bit in *Status Auxiliary.*
<Opt Intern Input>	Same as Opt Intern Input bit in *Status Auxiliary.*

<External Fault>	Same as External Fault bit in *Status Auxiliary*.
<Iin Limiting>	Same as Iin Limiting bit in Limit Bit Status.
<Iout Limiting>	Same as Iout Limiting bit in Limit Bit Status.
<Vout Limiting>	Same as Vout Limiting bit in Limit Bit Status.
<KWout Limiting>	Same as KWout Limiting bit in Limit Bit Status.
<Comm Fault>	Displays DeviceNet status driving SCR Control Supervisor.
<Comm Idle>	Displays DeviceNet status driving SCR Control Supervisor.
<Local RegMode> (Register)	Special local control that can modify regulation mode only when the local panel provides the setpoint.
<Local Setpoint%> (Register)	Similar to Net Setpoint%.

Table 37 Modbus Coil Definitions

<Local Fault Rst>	**Coil Number**	**00001**
If unit is faulted, this resets the faulted condition. This also resets the flags of alarms 'Iin Peak Fault' and 'Iin Timed OL' (even if the unit is not in a faulted condition). 0 = No action. 0->1 = Fault Reset. This parameter is automatically reset to zero when the command is executed. The master does not need to write zero to clear the value. Typically, the action will be executed and value cleared before the master can read again, so the value normally reads back as zero.	Register Address	40001:bit0
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	No
DeviceNet Access	Attribute	
	Access Rule	

<LocalCtrl>	**Coil Number**	**00002**
Local Control request to take over Run/Stop control using 'Local Run1'. Since this has highest control priority, it will always be acknowledged by 'ControlFromLocal' This will clear ControlFromNet (if set) and override 'AutoRun'. 0 = Control based on AutoRun or CtrlFromNet 1 = Demands that 'ControlFromLocal' = 1. (Local Run1 will control Run/Stop) 'LocalCtrl' is analogous to an Run/Stop-Auto/Manual selector switch that connects a Run/Stop switch into the control path. 'Local Run1' is analogous to the Run/Stop switch.	Register Address	40001:bit1
	Access Rule	Get / Set
	Default Value	-
	Nonvolatile	Conditional If 'Local Control NV' = 1, this is nonvolatile and returns to last value written. If 'Local Control NV' = 0, this resets to 0 on power-up reset.
DeviceNet Access	Attribute	
	Access Rule	

<Local Run1>	**Coil Number**	**00003**
Controls Run/Stop if 'CtrlFromLocal' = 1. 0 = Stop command 1 = Run command Maintained. If Local Auto/Man = 1, this 'Local Run1' has overriding control.	Register Address	40001:bit2
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	Conditional If 'Local Control NV' = 1, this is nonvolatile and returns to last value written. If 'Local Control NV' = 0, this resets to 0 on power-up reset.
DeviceNet Access	Attribute	
	Access Rule	

<LocalRef Demand>	**Coil Number**	**00004**
Overriding command that allows the SCR setpoint and regulation mode to be specified by local digital data. Local Setpoint% and Regulation Mode enabled. 0 = Setpoint source is Analog or from network, 'Auto RegMode' controls regulation. 1 = 'Local Setpoint%' is the controller setpoint input, 'Local RegMode' sets the regulation mode. Local Ref Enable overrides NetRef (if used) and will force 'RefFromNet. = 0. 'LocalRef Demand is analogous to a Setpoint-Auto/Manual switch that connects a setpoint potentiometer into the control path. 'Local Setpoint%' is analogous to the potentiometer. Optionally, it also selects a different regulation mode when the setpoint is controlled manually.	Register Address	40001:bit3
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	Conditional If 'Local Setpt NV = 1, this is nonvolatile and returns to last value written. If 'Local Setpt NV = 0, this resets to 0 on power-up reset.
DeviceNet Access	Attribute	
	Access Rule	

<KW Hour Reset>	**Coil Number**	**00005**
KW-hour meter reset command. 0 = No action. 0->1 = Reset KW-hour meter. This parameter is automatically reset to zero when the command is executed. The master does not need to write zero to clear the value. Typically, the action will be executed and value cleared before the master can read again, so the value normally reads back as zero.	Register Address	40001:bit4
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	No
DeviceNet Access	Attribute	
	Access Rule	

<Local ForceFault>	**Coil Number**	**00006**
Local digital fault command. This will force a faulted (tripped) state. Not maskable. 0 = No action. 0->1 = Initiate a fault trip. This parameter is automatically reset to zero when the command is executed. The master does not need to write zero to clear the value. Typically, the action will be executed and value cleared before the master can read again, so the value normally reads back as zero.	Register Address	40001:bit5
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	No
DeviceNet Access	Attribute	
	Access Rule	

<Local Relay Req>	**Coil Number**	**00007**
Local Relay Request to activate the relay. This is only a request because it is maskable in the 'Relay Mask'. 0 = Do not request relay activation. 1 = Request relay activation.	Register Address	40001:bit6
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	No
DeviceNet Access	Attribute	
	Access Rule	

<Reset SCR Contrl>	**Coil Number**	**00008**
Reset SCR Control Supervisor Object and any faults. This forces the SCRs to walk up again from zero setpoint. It also allows the controller to change firing modes, if the 'Firing Mode' was changed. 0 = No action. 0->1 = Reset SCR Control Supervisor Object. This parameter is automatically reset to zero when the command is executed. The master does not need to write zero to clear the value. Typically, the action will be executed and value cleared before the master can read again, so the value normally reads back as zero.	Register Address	40001:bit7
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	No
DeviceNet Access	Attribute	
	Access Rule	

<Local Control NV>	**Coil Number**	**00009**
Determines if 'LocalCtrl' and 'Local Run1' will function as nonvolatile values. 0 = 'LocalCtrl' and 'Local Run1' are reset to zero on the next power-up reset. 'AutoRun' will always determine start-up action. 1 = Saves and restores 'LocalCtrl' and 'Local Run1' to the their last values on the next power-up reset.	Register Address	40001:bit8
	Access Rule	Get / Set
	Default Value	1
	Nonvolatile	Yes
DeviceNet Access	Attribute	
	Access Rule	

<Local Setpt NV>	**Coil Number**	**00010**
Determines if 'LocalRef Demand', 'Local Setpoint%', and 'Local RegMode' will function as nonvolatile values. 0 = 'LocalRef Demand', 'Local Setpoint%', and 'Local RegMode' are reset to zero on the next power-up reset. 1 = Save and reload last saved 'LocalRef Demand', 'Local Setpoint%', and 'Local RegMode' on next powerup reset	Register Address	40001:bit9
	Access Rule	Get / Set
	Default Value	1
	Nonvolatile	Yes
DeviceNet Access	Attribute	
	Access Rule	

<Local PFZF Sel>	**Coil Number**	**00011**
Only functional if 'Firing Mode Sel' = 3 (3 = PFZF Data Switch control). 0 = Phase Firing 1 = Zero Firing, variable time base If PFZF Data Switch control is used, this attribute will select PF or ZF firing mode without the need to use 'LocalCtrl' to demand local control subject to the following exception. If DeviceNet is used to control the firing mode using 'Net_PFZF_Select', it must request control using 'NetCtrl'. If this is the case, the local panel must use 'LocalCtrl ' to force control back to 'Local_PFZF_Sel'.	Register Address	40001:bit10
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	No
DeviceNet Access	Attribute	
	Access Rule	

<Reserved1>	**Coil Number**	**00012**
	Register Address	40001:bit11
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	No
DeviceNet Access	Attribute	
	Access Rule	

<Reserved2>	**Coil Number**	**00013**
	Register Address	40001:bit12
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	No
DeviceNet Access	Attribute	
	Access Rule	

<Reserved3>	**Coil Number**	**00014**
	Register Address	40001:bit13
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	No
DeviceNet Access	Attribute	
	Access Rule	

<Reserved4>	**Coil Number**	**00015**
	Register Address	40001:bit14
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	No
DeviceNet Access	Attribute	
	Access Rule	

<Set Time /Reserved5>	**Coil Number**	**00016**
	Register Address	40001:bit15
	Access Rule	Get / Set
	Default Value	0
	Nonvolatile	No
DeviceNet Access	Attribute	
	Access Rule	

<Faulted>	**Coil Number**	**00017**
See DeviceNet Parameter 152 description.	Register Address	40002:bit0
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 152	Object Mapping	$8D_{hex}$-1-10
	Access Rule	Get

<Warning>	**Coil Number**	**00018**
See DeviceNet Parameter 153 description.	Register Address	40002:bit1
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 153	Object Mapping	$8D_{hex}$-1-11
	Access Rule	Get

<Running1>	**Coil Number**	**00019**
See DeviceNet Parameter 154 description.	Register Address	40002:bit2
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 154	Object Mapping	$8D_{hex}$-1-7
	Access Rule	Get

<SCR AC In Status>	**Coil Number**	**00020**
See DeviceNet Parameter 155 description.	Register Address	40002:bit3
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 155	Object Mapping	65_{hex}-1-6
	Access Rule	Get

<Ready>	**Coil Number**	**00021**

See DeviceNet Parameter 156 description.	Register Address	40002:bit4
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 156	Object Mapping	$8D_{hex}$-1-9
	Access Rule	Get

<CtrlFromNet>	**Coil Number**	**00022**
See DeviceNet Parameter 157 description.	Register Address	40002:bit5
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 157	Object Mapping	$8D_{hex}$-1-15
	Access Rule	Get

<RefFromNet>	**Coil Number**	**00023**
See DeviceNet Parameter 158 description.	Register Address	40002:bit5
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 158	Object Mapping	65_{hex}-1-2
	Access Rule	Get

<At Setpoint>	**Coil Number**	**00024**
See DeviceNet Parameter 159 description.	Register Address	40002:bit6
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 159	Object Mapping	65_{hex}-1-3
	Access Rule	Get

<CtrlFromLocal>	**Coil Number**	**00025**
See DeviceNet Parameter 160 description.	Register Address	40002:bit7
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 160	Object Mapping	65_{hex}-1-7
	Access Rule	Get

<RefFromLocal>	**Coil Number**	**00026**
See DeviceNet Parameter 161 description.	Register Address	40002:bit8
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 161	Object Mapping	65_{hex}-1-8
	Access Rule	Get

<RefFromAnalog>	**Coil Number**	**00027**
See DeviceNet Parameter 162 description.	Register Address	40002:bit9
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 162	Object Mapping	65_{hex}-1-9
	Access Rule	Get

<Relay State>	**Coil Number**	**00028**
See DeviceNet Parameter 163 description.	Register Address	40002:bit10
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 163	Object Mapping	65_{hex}-1-15
	Access Rule	Get

<Enable Output>	**Coil Number**	**00029**
See DeviceNet Parameter 164 description.	Register Address	40002:bit11
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 164	Object Mapping	65_{hex}-1-16
	Access Rule	Get

<Max Duty Cycle>	**Coil Number**	**00030**
See DeviceNet Parameter 165 description.	Register Address	40002:bit12
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 165	Object Mapping	65_{hex}-1-11
	Access Rule	Get

<Summary Limiting>	**Coil Number**	**00031**
See DeviceNet Parameter 166 description.	Register Address	40002:bit14
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 166	Object Mapping	65_{hex}-1-10
	Access Rule	Get

<INPUT1 Discrete>	**Coil Number**	**00032**
See DeviceNet Parameter 167 description.	Register Address	40002:bit15
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 167	Object Mapping	65_{hex}-1-139
	Access Rule	Get

<Vin RMS High>	**Coil Number**	**00033**

Voltage % Input High alarm flag status. 0 = Voltage below high setting. 1 = Voltage >= high setting.	Register Address	40003:bit0
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit0
	Access Rule	Get

<Vin RMS Low>	**Coil Number**	**00034**
Voltage % Input Low alarm flag status. 0 = Voltage not low. 1 = Voltage <= low setting.	Register Address	40003:bit1
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit1
	Access Rule	Get

<Iin Peak Fault>	**Coil Number**	**00035**
If the peak input current exceeds 'Iin PeakFault%' for two consecutive cycles, the SCRs turn off momentarily and walk back on. Such momentary trips are counted and logged in the event log. The first trip also starts a counter that counts up to the number of seconds specified in 'Iin Peak Timer'. 'Iin Peak Retry' specifies an allowed number of auto-resetting trips. If the number of allowed trips exceed the allowed count within the time limit, the unit will set this flag 'Iin Peak Fault'. If the alarm is enabled in the 'Fault Mask', it will trigger a faulted condition until the unit is reset. 0 = No overcurrent fault. 1 = This is a latched flag that feeds the 'Fault Mask'. If the 'Fault Mask' bit is 1, it will generate a faulted condition. This flag will be held until a fault reset is issued.	Register Address	40003:bit2
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit2
	Access Rule	Get

<Iin Timed OL>	**Coil Number**	**00036**
Continuous output current exceeding “in RMS OL%’ for a time period specified in ‘Iin RMS OL Timer’. 0 = No overcurrent. 1 = This is a latched flag that feeds the ‘Fault Mask’ and ‘Warning Mask’. If the ‘Fault Mask’ bit is 1, it will generate a faulted condition. This flag will be held until a fault reset is issued. If the ‘Warning Mask’ bit is 1, it will generate a warning condition as a less severe advisory. This flag will be held until a fault reset is issued.	Register Address	40003:bit3
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit3
	Access Rule	Get

<Heatsink OT>	**Coil Number**	**00037**
Discrete input with programmable polarity. 0 = Thermostat normal. 1 = Thermostat tripped.	Register Address	40003:bit4
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit4
	Access Rule	Get

<SCRShort/OutOpen>	**Coil Number**	**00038**
SCR Short or Output Open alarm flag status. Running1 = 0 AND voltage > 75% of Output Voltage Rating for 4 seconds. 0 = No warning 1 = Open Output or possible SCR Shorted	Register Address	40003:bit5
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit5
	Access Rule	Get

<SCR Short/w Amps>	**Coil Number**	**00039**
SCR Shorted with Current alarm flag status. Running1 = 0 AND Input Current >5% for 4 seconds 0 = SCR Not Shorted 1 = SCR Shorted	Register Address	40003:bit6
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit6
	Access Rule	Get

<Freq Deviation>	**Coil Number**	**00040**
0 = Frequency nominal. 1 = Frequency exceeds window specified.	Register Address	40003:bit7
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit7
	Access Rule	Get

<High Ambient>	**Coil Number**	**00041**
0 = Temp nominal. 1 = Temp > Ambient Overtemperature Limit.	Register Address	40003:bit8
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit8
	Access Rule	Get

<Fuse Switch Out>	**Coil Number**	**00042**
Fuse Switch Discrete alarm flag status. Discrete input with programmable polarity. 0 = Fuse switch normal. 1 = Fuse switch activated. Fuse switch can be manually opened for test, check fuse.	Register Address	40003:bit9
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit9
	Access Rule	Get

<Load Res High>	**Coil Number**	**00043**
Load Resistance High alarm flag status. 0 = Load nominal. 1 = Load > Load Resistance High Limit AND Vout > 10%.	Register Address	40003:bit10
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit10
	Access Rule	Get

<Load Res Low>	**Coil Number**	**00044**
Fuse Switch Discrete alarm flag status. Discrete input with programmable polarity. 0 = Fuse switch normal. 1 = Fuse switch activated. Fuse switch can be manually opened for test, check fuse.	Register Address	40003:bit11
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit11
	Access Rule	Get

<Watchdog Tripped>	**Coil Number**	**00045**
Watchdog Tripped 0 = Not tripped. 1 = Tripped.	Register Address	40003:bit12
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit11
	Access Rule	Get

<NV Cfg Checksum>	**Coil Number**	**00046**
NV Config Checksum 0 = Normal. 1 = Error. Reload defaults on reset.	Register Address	40003:bit13
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit13
	Access Rule	Get

<Opt Intern Input>	**Coil Number**	**00047**
Indicates the value of the Optional Discrete Input (internal) terminal. Reserved for internal HDR use. Pull-up resistor, so normally true if not inverted. 0 = Optional Input is inactive. 1 = Optional Input is active.	Register Address	40003:bit14
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit14
	Access Rule	Get

< External Fault >	**Coil Number**	**00048**
External Fault Discrete alarm flag status. Discrete input with programmable polarity. 0 = Contacts open. 1 = Contacts closed.	Register Address	40003:bit15
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit15
	Access Rule	Get

<Iin Limiting>	**Coil Number**	**00049**
Current Input Limiting is limiting output. 0 = Not limiting 1 = Iin limiting.	Register Address	40004:bit0
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access Parameter 19	Object Mapping	65_{hex}-1-138:bit0
	Access Rule	Get

<Iout Limiting>	**Coil Number**	**00050**
Current Input Limiting is limiting output. 0 = Not limiting 1 = Iout limiting.	Register Address	40004:bit1
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access	Object Mapping	xxxxxxxx
	Access Rule	Get

<Vout Limiting>	**Coil Number**	**00051**
Current Input Limiting is limiting output. 0 = Not limiting 1 = Vout limiting.	Register Address	40004:bit2
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access	Object Mapping	xxxxxxxx
	Access Rule	Get

<KWout Limiting>	**Coil Number**	**00052**
Current Input Limiting is limiting output. 0 = Not limiting 1 = KWout limiting.	Register Address	40004:bit3
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access	Object Mapping	xxxxxxxx
	Access Rule	Get

<Spare1>	**Coil Number**	**00053**
	Register Address	40004:bit4

<Spare2>	**Coil Number**	**00054**
	Register Address	40004:bit5

<Spare3>	**Coil Number**	**00055**
	Register Address	40004:bit6

<Spare4>	**Coil Number**	**00056**
	Register Address	40004:bit7

<Spare5>	**Coil Number**	**00057**
	Register Address	40004:bit8

<Spare6>	**Coil Number**	**00058**
	Register Address	40004:bit9

<Spare7>	**Coil Number**	**00059**
	Register Address	40004:bit10

<Spare8>	**Coil Number**	**00060**
	Register Address	40004:bit11

<Spare9>	**Coil Number**	**00061**
	Register Address	40004:bit12

<Spare10>	**Coil Number**	**00062**
	Register Address	40004:bit13

<Comm Fault>	**Coil Number**	**00063**
Monitors DeviceNet connection status for SCR Control Supervisor. 0 = One or more DeviceNet connections. 1 = No DeviceNet connections.	Register Address	40004:bit14
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access	Object Mapping	None
	Access Rule	None

<Comm Idle>	**Coil Number**	**00064**
Monitors for DeviceNet idle messages for SCR Control Supervisor.. 0 = No idle messages received. 1 = Idle Message received.	Register Address	40004:bit15
	Access Rule	Get
	Default Value	None
	Nonvolatile	No
DeviceNet Access	Object Mapping	None
	Access Rule	None

The following tables list the unique Modbus Registers. Note that Modbus has Get/Set capability of <Local RegMode> and <Local Setpoint%> while DeviceNet may only monitor these values.

Table 38 Modbus Register Definitions

<Local RegMode>	**Register Number**	**40006**
Local Regulation Mode Selector This regulation mode will be used if 'Local Ref Demand' = 1. 0 = Use Existing 'Auto RegMode' 1 = Voltage 2 = Current 3 = Power 4 = Resistance 5 = Analog Feedback% 6= Open Loop 'Local Setpt NV' determines Reset/Startup value selection. This allows the regulation mode to be automatically changed only when the local control panel enables manual setpoint control using 'Local Setpoint%'. If this is left equal to zero, it has no affect and the unit uses the same regulation mode in automatic control and manual control. NOTE: All Modes available with Phase Firing. All Zero Fire Modes are limited to Voltage and Open Loop.	Access Rule	Get / Set
	Minimum Value	0
	Maximum Value	6
	Default Value	0
	Nonvolatile	Conditional If 'Local Setpt NV' = 1, this is nonvolatile and returns to last value written. If 'Local Setpt NV' = 0, this resets to 0 on power-up reset.
DeviceNet Access Parameter 184	Attribute	0x65-1-049
	Access Rule	Get

<Local Setpoint%>	**Register Number**	**40007**
Local Regulation Setpoint. This is the controlling setpoint enabled when 'Local Ref Demand' = 1 and 'CtrlFromLocal' = 1. Normal setpoint range is 0-100.00%, or 0-10000 (ignoring user display decimal placement). The maximum value of 12500 allows an overrange input (if the input device is programmed to send a number over 10000..	Access Rule	Get / Set
	Minimum Value	0
	Maximum Value	12500
	Default Value	0
	Nonvolatile	Conditional If 'Local Setpt NV' = 1, this is nonvolatile and returns to last value written. If 'Local Setpt NV' = 0, this resets to 0 on power-up reset.
DeviceNet Access Parameter 183	Attribute	0x65-1-048
	Access Rule	Get

9.3 Nonvolatile Modbus Manual Controls

In many SCR controller applications, it is essential that the system have manual control capability. This typically requires front panel meters, an Auto/Manual switch to transfer the normal 4-20 mA automated setpoint control to a manual locking potentiometer, and sometimes an Auto/Manual switch to enable a local Run/Stop switch.

Such manual control allows a person to control Run/Stop and allows the setpoint command signal to be manually set. The setpoint is usually set while monitoring simple voltage, current, or power meters, and a historic knowledge of what power level is needed to generally maintain furnace temperatures. One critical aspect of manual control is that all power can be lost and the unit will still return to the same manual settings when power is restored.

Specific Modbus command parameters have nonvolatile and conditional-nonvolatile characteristics. This allows a simple control panel to have a memory of its manual settings.

Run/Stop Manual Control
If <Local Control> is true, then the manual panel will have run/stop control capability using <Local Run1>.
If <Local Control> is false, the unit starts and runs automatically as if there were no local digital control panel. <Local Control NV> is the nonvolatile configuration parameter that determines if <Local Control> and <Local Run1> are nonvolatile.
If <Local Control NV> is true, the controls will be nonvolatile and upon power loss and restoration, the unit will return to the last saved values of <Local Control> and <Local Run1>.
If <Local Control NV> is false, then the other values are volatile and will be reset when power cycles. In this case, the unit will always power-up and start in automatic control as if there were no control panel.

Setpoint Manual Control
If <Local Ref Demand> is true, then the manual panel will have command setpoint control and <Local Setpoint%> will be the setpoint value controlling the unit.
If <Local Ref Demand> is false, the unit starts and runs automatically as if there were no local digital control panel.
<Local Setpoint NV> is the nonvolatile configuration parameter that determines if <Local Ref Demand> and <Local Setpoint%> are nonvolatile.
If <Local Setpoint NV> is true, the controls will be nonvolatile and upon power loss and restoration, the unit will return to the last saved values of <Local Ref Demand> and <Local Setpoint%>.
If <Local Setpoint NV> is false, then the other values are volatile and will be reset when power cycles. In this case, the unit will always start in automatic control as if there were no control panel.

The parameters <Local Control> and <Local Ref Demand> are independent. This means you can take over manual run/stop control and continue to run on the internal

analog input setpoint. Or you can take over only the setpoint control without concern for run/stop controls.

The values <Local Control NV> and <Local Setpoint NV> are enabled by default, but may be cleared to disable this feature for applications that desire to always revert to automatic control when power cycles.

Benefit – This feature allows the simplest mini-HMI panel to replace the traditional auto/manual switches and potentiometer for manual control.

9.4 Reserved Registers

The following Modbus Registers are reserved for the manufacturer's use for future expansion, special test support, and HMI support. The user should not write to these Registers.

40029
40202
40203
40204
40205
40206-40221
40202
40223-40264
40265
40265??

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10 MAINTENANCE

10.1 Environmental Concerns

Always verify that the unit is mounted in a clean, dust free environment. Clean the heat sink and printed circuit board periodically so no dust and/or dirt accumulates on the unit. Dust and/or dirt on the heat sink fins can prevent proper airflow causing overheating of the semiconductors. Conductive dust and/or dirt can cause shorts or arcing, which can cause damage to the unit.

Always size your enclosure so that a 50 °C maximum internal ambient temperature is never exceeded.

10.2 Line/Load Power Connections

Periodically turn the power off to the unit and check for corrosion and tightness of the power connections. If any corrosion is evident, clean the cable and connector and reconnect making sure to tighten according to our torque specifications.

10.3 Static Precautions When Servicing

When servicing the Firing Circuit or option Printed Circuit Board (PCB), damage can occur due to static electricity. Always use a wrist strap grounded through a 1 megohm resistor. Transport the PCB in a static shielding bag. Caution in handling the PCB can help prevent any further damage to the PCB.

If you are not familiar with static precautions, consult the factory for additional details.

10.4 Troubleshooting Typical Symptoms

See Factory.

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11 SERVICE AND SPARE PARTS

11.1 Customer Service

If operational problems arise which cannot be resolved by review of all related procedures given in this book; please contact "Service" at Ametek HDR Power Systems.

NORMAL BUSINESS HOURS 8:00 a.m. to 5:00 p.m., USA EASTERN TIME ZONE,
* Monday through Friday.

TELEPHONE: (614) 308-5500. Our Answering Service will accept your messages at all off-hours including weekends. We receive those messages at 8:00 a.m. on the next normal workday. We will respond at the earliest time possible, within your time zone and normal workday.

FACSIMILE: (614) 308-5506. Automatic reception during all hours.

*Mon-Fri. normal working hours in Greenwich Mean Time:
From first Sunday in November to the second Sunday in March; 12:00Z to 21:00Z
From second Sunday in March to first Sunday in November; 13:00Z to 22:00Z

If you are experiencing downtime or other circumstances that are truly critical during our off-hours (see above), and wish to telephone us, please inform our Answering Service operator of the nature and degree of your problem. In such cases, the operator is authorized to call the Service Department. We cannot, however, guarantee that service assistance will be available at any given off-hour time.

When we are reached by phone, our first step will be to give you over-the-phone assistance at no charge. If the problem cannot be resolved by phone we will arrange for service at your site or by shipment to Ametek HDR Power Systems, as you request. We will make every possible attempt to quickly support your emergency on-site needs, regardless of how contacted.

11.2 Spare Parts

Inside Sales should be contacted for any spare parts orders whether routine or emergency during normal working hours. All after hours requirements should be called in on our 614-308-5500 answering machine. Please have as much information available as possible pertaining to the model number, serial number, order number and parts required. A purchase order number should be available.

11.3 Warranty

AMETEK HDR warrants that the equipment delivered will be free from defects in workmanship and material for a period of five years from the date of shipment. AMETEK HDR will repair or replace, at AMETEK HDR's option, any part found defective during proper and normal use, provided that written notice of the nature of the defect is received by AMETEK HDR within the five year warranty period and that the customer returns the part to AMETEK HDR freight paid both ways. This warranty is not transferable by the initial end user.

AMETEK HDR MAKES NO OTHER WARRANTIES, EXPRESSED OR IMPLIED (INCLUDING, WITHOUT LIMITATION, MERCHANTABILITY, FITNESS FOR PURPOSE, OR AGAINST INFRINGEMENT OF ANY PATENT) EXCEPT AS EXPRESSLY PROVIDED HEREIN.

THE REMEDY OF REPAIR OR REPLACEMENT IS CUSTOMER'S SOLE AND EXCLUSIVE REMEDY AND WILL SATISFY ALL OF AMETEK HDR'S LIABILITIES, WHETHER BASED ON CONTRACT, NEGLIGENCE, TORT, PRODUCT LIABILITY, STRICT LIABILITY, OR OTHERWISE. IN NO EVENT WILL AMETEK HDR BE LIABLE FOR INCIDENT OR CONSEQUENTIAL DAMAGES, NOR IN ANY EVENT SHALL HDR'S LIABILITY EXCEED THE UNIT PRICE OF ANY DEFECTIVE PRODUCT OR PART.

Appendix A Configuration Checklist for the MP1 SCR DeviceNet Head

Use the following checklist to plan your system. This provides a convenient summary of only configuration parameters including default values and short descriptions.

Review the full manual for a complete description of all functions and capabilities. Be sure to review the full definitions of each variable as you consider it usage.

The MP1 SCR DeviceNet Head is designed to accommodate a variety of custom application. So, many of the possible parameters are probably not used in your application and can remain at the default value.

Note: Calibration Zero and Span Parameters are not listed in this form. Calibration is considered a hardware specific item that requires simulated signals with external metering. However, calibration, particularly the calibration of the analog command setpoint input, may be both calibration and configuration.

Analog setpoint calibration may be considered part of configuration if you are choosing between a 0-10V input or a 4-20 mA input. Once a particular input is chosen, the unit may be calibrated for accuracy.

		MP1 SCR DeviceNet Head Configuration Planner			
Line Item	Param.	Description of this unit:			
#	#	**Parameter Name**	**Comments**	**Default**	**Final Value**
		SCR Assembly Data			
1	**46**	*Vin PT Primary*	The nominal (100%) SCR AC input line voltage.	480	
2	**47**	*Vout PT Primary*	The nominal (100%) SCR output line voltage.	480	
3	**48**	*Current XFMR Cnt*	Number of C.T. used (1 or 2).	1	
4	**49**	*Iin XFMR Ratng*	Primary rating of input current transformer.	60	
5	**50**	*Iout XFMR Ratng*	Primary rating of output current transformer.	60	
		FiringMode Setup			
6	**55**	*Firing Mode Sel*	Selects Firing Mode for SCR timing controls. This must be configured for the desired firing mode.	1	
7	**56**	*PFZF Dly Time(r)*	Selects PFZF switching control source.	360	
8	**57**	*ZFT SPD Selector*	Starting Point Delay Source.	0	
9	**58**	*ZFT Walk Up Time*	Number of walk up cycles for the first turn-on.	10	
10	**59**	*ZFT Rep Cycle%*	Percent firing angle for first positive ZFT firing burst.	50	
11	**60**	*Slew Rate Limit*	Slew rate limit of SCR timing in cycles for 100% change.	10	
		Reg PI Setup			
12	**21**	*Vout Prop Gain*	Proportional gain, output voltage.	10	
13	**22**	*Vout Integ Gain*	Integral gain control, output voltage.	10	
14	**23**	*Iout Prop Gain*	Proportional gain, output current.	10	
15	**24**	*Iout Integ Gain*	Integral gain control, output current.	10	
16	**25**	*KWout Prop Gain*	Proportional gain, output power.	10	
17	**26**	*KWout Integ Gain*	Integral gain control, output power.	10	
18	**27**	*Resist Prop Gain*	Proportional gain, resistance regulation.	10	
19	**28**	*Resist Int Gain*	Integral gain control, resistance regulation.	10	
20	**29**	*ExtFB Prop Gain*	Proportional gain, external analog feedback.	10	

21	**30**	*ExtFB Integ Gain*	Integral gain control, external analog feedback.	10	
22	**31**	*Iin Prop Gain*	Proportional gain, input current.	10	
23	**32**	*Iin Integ Gain*	Integral gain control, input current.	10	
		Limits Setup			
24	**51**	*Iin RMS% Limit*	Iin RMS% regulation limit.	110	
25	**52**	*Vout RMS% Limit*	Vout RMS% regulation limit.	110	
26	**53**	*Iout RMS% Limit*	Iout RMS% regulation limit.	110	
27	**54**	*KW Output% Limit*	KW Output% regulation limit.	110	
		Alarm Setup			
28	**33**	*Vin High%*	Alarm if Vin Actual RMS% > *Vin High%.*	125	
29	**34**	*Vin Low%*	Alarm if Vin Actual RMS% < *Vin Low%.*	85	
30	**35**	*Iin PeakFault%*	Input Current Peak%.	0	
31	**36**	*Iin Peak Retry*	Input Current Peak Retry count.	0	
32	**37**	*Iin Peak Timer*	Input Current Peak Timer limit.	10	
33	**38**	*Iin RMS OL%*	Input RMS Current OL% limit.	125	
34	**39**	*Iin RMS OL Timer*	Input RMS Current OL% time.	10	
35	**40**	*Res Ratio High*	Alarm if Resistance Ratio > *Res Ratio High.*	10000	
36	**41**	*Res Ratio Low*	Alarm if Resistance Ratio < *Res Ratio Low.*	0	
37	**42**	*Freq Deviation*	Alarm if |Frequency Actual – Nominal Input Freq| > *Freq Deviation.*	4	
38	**43**	*Ambient OT Limit*	Alarm if Ambient Temp C > *Ambient OT Limit.*	75	

		Advanced Setup			
38	**137**	*Warning Mask*	Selects conditions that will generate a warning condition. Bit 15 is reserved. Data is ignored.	Bit 0=Comm Fault = 0	
				Bit 1=Comm Idle = 0	
				*Bit 2=High Ambient = 1	
				Bit 3=SCRShort/OutOpen = 0	
				Bit 4=Vin RMS High = 0	
				Bit 5=Vin RMS Low = 0	
				Bit 6=Summary Limiting = 0	
				Bit 7=Frequency Deviation = 0	
				Bit 8=Iin Timed OL = 0	
				Bit 9=SCR Short/w Amps = 0	
				Bit 10=Load Res High = 0	
				Bit 11=Load Res Low = 0	
				Bit 12=Fuse Switch Out = 0	
				Bit 13=Max Duty Cycle = 0	
				Bit 14=Internal Exc = 0	
				Bit 15=Reserved15 = 0	0
40	138	*Fault Mask*	Bitmask selecting which alarms may trigger a fault. Note: Bits 11, 12, and 14 are either modified automatically or fixed. You may write any value to these bits. It will be ignored. Bits 6, 10, and 15 is reserved. Data is ignored.	Bit 0=INPUT1 = 0	
				*Bit 1=Heatsink OT = 1	
				Bit 2= High Ambient = 0	
				Bit 3=SCRShort/OutOpen = 0	
				Bit 4=Vin RMS High = 0	
				Bit 5=Vin RMS Low = 0	
				Bit 6=Reserved6 = 0	0
				Bit 7=Iin Peak Fault = 0	
				Bit 8=Iin Timed OL = 0	
				Bit 9= Reserved9 = 0	0
				Bit 10=Reserved10 = 0	0
				Bit 11= Comm Fault = Auto	0 (Auto)
				Bit 12=Comm Idlev = Auto	0 (Auto)
				Bit 13=Warning = 0	
				*Bit 14=External Fault = 1	1
				Bit 15=Reserved15 = 0	0

41	139	*Relay Mask*	Bitmask selecting which alarms may trigger the relay. Bit 15 is reserved. Data is ignored.	Bit 0=INPUT1 = 0	
				Bit 1=Heatsink OT = 0	
				Bit 2=High Ambient = 0	
				Bit 3=SCRShort/OutOpen = 0	
				Bit 4=Vin RMS High = 0	
				Bit 5=Vin RMS Low = 0	
				Bit 6= Warning = 0	
				Bit 7=Frequency Deviation = 0	
				*Bit 8=Fault = 1	
				Bit 9=SCR Short/w Amps = 0	
				Bit 10=Load Res High = 0	
				Bit 11=Load Res Low = 0	
				Bit 12=Fuse Switch Out = 0	
				Bit 13=Local Relay = 0	
				Bit 14= Remote Relay Req = 0	
				Bit 15=Reserved15 = 0	0
42	140	*Invert Discretes*	Bitmask that may invert any discrete input or the relay output. Bits 6-14 are reserved. Data is ignored.	Bit 0=INPUT1 = 0	
				Bit 1=Output Enable = 0	
				Bit 2=External Fault = 0	
				Bit 3=Fuse Switch = 0	
				Bit 4=Heatsink OT = 0	
				Bit 5=Opt. Internal Input = 0	
				Bit 6=Reserved = 0	0
				Bit 7=Reserved = 0	0
				Bit 8=Reserved = 0	0
				Bit 9=Reserved = 0	0
				Bit 10=Reserved = 0	0
				Bit 11=Reserved = 0	0
				Bit 12=Reserved = 0	0
				Bit 13=Reserved = 0	0
				Bit 14=Reserved = 0	0
				Bit 15=Relay Output = 0	
43	141	*NetFaultMode*	Selects DeviceNet NetFault action.	1	
44	142	*NetIdleMode*	Selects DeviceNet NetIdle action.	1	
45	195	*AutoRun*	Selects whether the unit runs or stops with only internal control.	1	
46	196	*Auto RegMode NV*	Selects the regulation mode used at power-up.	1	

		MA DAC Setup			
47	117	*DAC Out1 FS*	Selects the data source for mA transmitter 1.	65535	
48	118	*DAC Out2 FS*	Selects the data source for mA transmitter 2.	65535	
49	119	*DAC Out3 FS*	Selects the data source for mA transmitter 3.	65535	
50	120	*DAC Out1 Select*	Specifies the 100% level for the 16-bit DAC for transmitter 1.	4	
51	121	*DAC Out2 Select*	Specifies the 100% level for the 16-bit DAC for transmitter 1.	5	
52	122	*DAC Out3 Select*	Specifies the 100% level for the 16-bit DAC for transmitter 1.	6	
		Ramp Rates Setup			
53	61	*Ramp Up Time*	Rising rate of change limiter applied to the incoming setpoint.	2	
54	62	*Ramp Down Time*	Falling rate of change limiter applied to the incoming setpoint.	2	
		Event Log			
55	*82*	*Log Config*	Selects controller events only, or adds DeviceNet network events.	0	
		A/B Serial Ports			
56	99	*Modbus A Addr*	RS-232: Selects Modbus address.	1	
57	100	*ABaud Rate*	RS-232: Selects Baud Rate.	3	
58	101	*AParity/StopBits*	RS-232: Selects Parity/Stop Bit combination.	2	
59	102	*Modbus B Addr*	RS-485: Selects Modbus address.	1	
60	103	*BBaud Rate*	RS-485: Selects Baud Rate.	3	
61	104	*BParity/StopBits*	RS-485: Selects Parity/Stop Bit combination.	2	

		DeviceNet Setup			
62	69	*AssyWord0 Param*	Parameter number of the value to be placed in Word 0 location.	11	
63	70	*AssyWord1 Param*	Parameter number of the value to be placed in Word 1 location.	9	
64	71	*AssyWord2 Param*	Parameter number of the value to be placed in Word 2 location.	13	
65	72	*AssyWord3 Param*	Parameter number of the value to be placed in Word 3 location.	10	
66	73	*AssyWord4 Param*	Parameter number of the value to be placed in Word 4 location.	8	
67	74	*AssyWord5 Param*	Parameter number of the value to be placed in Word 5 location.	12	
68	75	*AssyWord6 Param*	Parameter number of the value to be placed in Word 6 location.	5	
69	76	*AssyWord7 Param*	Parameter number of the value to be placed in Word 7 location.	4	
70	77	*AssyWord8 Param*	Parameter number of the value to be placed in Word 8 location.	18	
71	78	*AssyWord9 Param*	Parameter number of the value to be placed in Word 9 location.	3	
72	79	*AssyWord10 Param*	Parameter number of the value to be placed in Word 10 location.	2	
73	80	*Output Assembly*	Default start-up output assembly.	102	
74	81	*Input Assembly*	Default start-up input assembly.	152	
75	223	*Program Lock*	Parameter lock value.	0	
Analog Input Specification for Configuration/Calibration					
Installer's Reference: For the Analog Setpoint Input and Analog Feedback Input, write in the nominal signal type that the hardware should be configured/calibrated to use. (i.e. N.A., 0-10v, 2-10v, 0-20 mA, 4-20 mA, potentiometer, etc.) A mA specification also indicates that a resistor must be included. The command setpoint input includes a resistor internally that is connected with an external jumper.				*Analog Setpoint Input Type (if used)*	
				Analog Feedback Input Type (if used)	
		End of MP1 SCR DeviceNet Head Configuration Planner			

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Appendix B DeviceNet Statement of Conformance

General Device Data

Conforms to DeviceNet Specification:	Volume I – Release 2.0 Volume II – Release 2.0 Errata
Vendor Name:	Ametek HDR Power Systems
Device Profile:	Generic Device
Product Name:	MP1 SCR DeviceNet Head
Product Code:	97
Product Revision:	2.001

DeviceNet Physical Conformance Data

Network Power Consumption (Max):	0.052 A @ 11 V dc (worst case)
Connector Style:	Open-Pluggable, gold plated.
Isolated Physical Layer:	Yes
LEDs Supported:	Module, Network
MAC ID Setting:	Rotary Switch + Software Settable
Default MAC ID:	63
Communication Rate Setting:	Rotary Switch + Software Settable
Communication Rates Supported:	125k, 250k, 500k bit/s

DeviceNet Communication Data

Device Network Behavior:	Group 2 Server

UCMM Explicit Message Groups Supported		Group1		Group 2		Group 3	x	
Dynamic I/O Message Groups (Peer to Peer)		Group1	x	Group 2		Group 3		
Default I/O Data Address Path	Input:	Class	4	Inst.	152	Attr.	3	
	Output:	Class	4	Inst.	102	Attr.	3	

Fragmented Explicit Messaging Supported			Yes	x			No	
Acknowledge TimeOut	1000 ms							
Typical Target Addresses								
Consumption	Service	16	Class	1	Inst.	1	Attr.	7
Production	Service	14	Class	1	Inst.	1	Attr.	7

The MP1 SCR DeviceNet Head supports the following DeviceNet object classes:

Table 39 DeviceNet Object Classes

Class	Object
0x01	Identity
0x02	Message Router
0x03	DeviceNet
0x04	Assembly
0x05	Connection
0x65	SCR Controller
0x8D	SCR Control Supervisor
0xAE	DeviceNet Interface Object

Explanation of DeviceNet Get/Set
Get indicates attribute value is returned by the Get_Attribute_Single service.
Set indicates attribute value is written to by the Set_Attribute_Single service.

Identity Object – Class Code 0x01

The following class attributes are supported for the Identity Object.

Table 40 Identity Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instance	UINT	1

A single instance of the Identity Object is supported. The following instance attributes are supported.

Table 41 Identity Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Vendor ID	UINT	977 = Ametek HDR Power Systems
2	Get	Device Type	UINT	0 = Generic Device
3	Get	Product Code	UINT	97
4	Get	Revision Major Minor	Structure of: USINT USINT	 1(rev1.001) or 2(rev2.001) 1
5	Get	Status	WORD	0 = Not owned 1 = Owned by master
6	Get	Serial Number	UDINT	Unique number
7	Get	Product Name String Length ASCII String	Structure of: USINT STRING Structure of: USINT STRING	MP1 SCR DeviceNet Head
8	Get	State	Present state of the device as represented by the state transition diagram	0 = Nonexistent 1 = Device Self Testing 2 = Standby 3 = Operational 4 = Major Recoverable Fault 5 = Major Unrecoverable Fault 6 – 254 = Reserved 255 = Default for Get_Attributes_All service

The following common services are implemented for the Identity Object.

Table 42 Identity Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x05	No	Yes	Reset (DeviceNet Only)

Message Router – Class Code 0x02

No class or instance attributes are supported. The message router object exists only to route explicit messages to other objects.

DeviceNet Object – Class Code 0x03

The following class attributes are supported for the DeviceNet Object.

Table 43 DeviceNet Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	2

A single instance of the DeviceNet Object is supported. The following instance attributes are supported.

Table 44 DeviceNet Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get/Set*	MAC ID	USINT	Range 0-63
2	Get/Set*	Baud Rate	USINT	0 = 125 kbaud 1 = 250 kbaud 2 = 500 kbaud
3	Get/Set	BOI	BOOL	
4	Get/Set	Bus-Off Counter	USINT	Range 0-255
5	Get	Allocation Information	Structure of:	
		Allocation Choice Byte	BYTE	Allocation byte Bit 0 = Explicit Messaging Bit 1 = Polled I/O
		Master's MAC ID	USINT	0-63 = address 255 = unallocated
6	Get	MAC ID Switch Changed	BOOL	0 = No Change 1 = Change since last Reset or Power-up.
7	Get	Baud Rate Switch Changed	BOOL	0 = No Change 1 = Change since last Reset or Power-up.
8	Get	MAC ID Switch Value	USINT	Range 0-99
9	Get	Baud Rate Switch Value	USINT	Range 0-9

*MAC ID and Baud Rate are only Settable if their respective Rotary Switches are in the PGM (programmable) positions.

The following common services are implemented for the DeviceNet Object.

Table 45 DeviceNet Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single
0x4B	No	Yes	Allocate_Master/Slave_ Connection_Set
0x4C	No	Yes	Release_Group_2 _Identifier_Set

Assembly Object – Class Code 0x04

The following class attributes are supported for the Assembly Object.

Table 46 Assembly Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	2
3	Get	Number of Instances	UINT	7

The following Assembly Instances are implemented.
Only Attibute 3 (Data) is supported for each assembly instance.

Static Output Assemblies: 102, 103, and 104

Table 47 Assembly Object Instance 102, 0x66, Data Format (DEFAULT)

(Identical to Basic Overload Output Assembly 2 from ODVA Overload Profile)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						FaultRst		

Table 48 Assembly Object Instance 103, 0x67, Data Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ForceFault Trip	NetRef	NetCtrl	Net PFZF Select	NetKW Hour Reset	FaultRst	Remote Relay Req	Run1
1	Auto RegMode*							
2	Net Setpoint% (low byte)							
3	Net Setpoint% (high byte)							

* Note that if byte Auto RegMode = 0 = No Change to the Regulation Mode

Table 49 Assembly Object Instance 104, 0x68 Data Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	ForceFault Trip	NetRef	NetCtrl	Net PFZF Select	NetKW Hour Reset	FaultRst	Remote Relay Req	Run1
1	Auto RegMode*							
2	Net Setpoint% (low byte)							
3	Net Setpoint% (high byte)							
4	DAC Out1 Ref (low byte)							
5	DAC Out1 Ref (high byte)							
6	DAC Out2 Ref (low byte)							
7	DAC Out2 Ref (high byte)							
8	DAC Out3 Ref (low byte)							
9	DAC Out3 Ref (high byte)							

* Note that if byte Auto RegMode = 0 = No Change to the Regulation Mode

The following table indicates the I/O Assembly Data Attribute mapping for Output Assemblies:

Table 50 Assembly Data Attribute Mapping for Output Assemblies

Data Component Name	Class		Instance Number	Attribute		
	Name	Number		Name	Number	Type
Run1	SCR Control Supervisor	$8D_{hex}$	1	Run1	3	BOOL
Remote Relay Req	SCR Controller	65_{hex}	1	Remote Relay Req	12	BOOL
FaultRst	SCR Control Supervisor	$8D_{hex}$	1	FaultRst	12	BOOL
NetKW Hour Reset	SCR Controller	65_{hex}	1	NetKW Hour Reset	13	BOOL
Net PFZF Select	SCR Controller	65_{hex}	1	Net PFZF Select	14	BOOL
NetCtrl	SCR Control Supervisor	$8D_{hex}$	1	NetCtrl	5	BOOL
NetRef	SCR Controller	65_{hex}	1	NetRef	1	BOOL
ForceFault Trip	SCR Control Supervisor	$8D_{hex}$	1	ForceFault Trip	17	BOOL
Auto RegMode	SCR Controller	65_{hex}	1	Auto RegMode	4	USINT
Net Setpoint%	SCR Controller	65_{hex}	1	Net Setpoint%	5	UINT
DAC Out1 Ref	SCR Controller	65_{hex}	1	DAC Out1 Ref	17	UINT
DAC Out2 Ref	SCR Controller	65_{hex}	1	DAC Out2 Ref	18	UINT
DAC Out3 Ref	SCR Controller	65_{hex}	1	DAC Out3 Ref	19	UINT

Static Input Assemblies: 151, 152, 153, and 154

Table 51 Assembly Object Instance 151, 0x97, Data Format

(Identical to Extended Overload Input Assembly 51 from ODVA Overload Profile)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0							Warning	Faulted

Table 52 Assembly Object Instance 152, 0x98 Data Format (DEFAULT)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Setpoint	RefFrom Net	CtrlFrom Net	Ready	SCR AC In Status	Running1	Warning	Faulted
1	INPUT1 Discrete	Summary Limiting	Max Duty Cycle	Output Enable	Relay State	RefFrom Analog	RefFrom Local	CtrlFrom Local
2	*Value of parameter pointed to by AssyWord0 Param (Low Byte)							
3	*Value of parameter pointed to by AssyWord0 Param (High Byte)							
4	*Value of parameter pointed to by AssyWord1 Param (Low Byte)							
5	*Value of parameter pointed to by AssyWord1 Param (High Byte)							
6	*Value of parameter pointed to by AssyWord2 Param (Low Byte)							
7	*Value of parameter pointed to by AssyWord2 Param (High Byte)							

*** BOOL and USINT parameters are filled with leading zeros to fit two bytes. UDINT parameters have no defined result, but are all available as split UINT parameters.**

Table 53 Assembly Object Instance 153, 0x99 Data Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Setpoint	RefFrom Net	CtrlFrom Net	Ready	SCR AC In Status	Running1	Warning	Faulted
1	INPUT1 Discrete	Summary Limiting	Max Duty Cycle	Output Enable	Relay State	RefFrom Analog	RefFrom Local	CtrlFrom Local
2	*Value of parameter pointed to by AssyWord0 Param (Low Byte)							
3	*Value of parameter pointed to by AssyWord0 Param (High Byte)							
4	*Value of parameter pointed to by AssyWord1 Param (Low Byte)							
5	*Value of parameter pointed to by AssyWord1 Param (High Byte)							
6	*Value of parameter pointed to by AssyWord2 Param (Low Byte)							
7	*Value of parameter pointed to by AssyWord2 Param (High Byte)							
8	*Value of parameter pointed to by AssyWord3 Param (Low Byte)							
9	*Value of parameter pointed to by AssyWord3 Param (High Byte)							
10	*Value of parameter pointed to by AssyWord4 Param (Low Byte)							
11	*Value of parameter pointed to by AssyWord4 Param (High Byte)							
12	*Value of parameter pointed to by AssyWord5 Param (Low Byte)							
13	*Value of parameter pointed to by AssyWord5 Param (High Byte)							
14	*Value of parameter pointed to by AssyWord6 Param (Low Byte)							
15	*Value of parameter pointed to by AssyWord6 Param (High Byte)							

*** BOOL and USINT parameters are filled with leading zeros to fit two bytes. UDINT parameters have no defined result, but are all available as split UINT parameters.**

Table 54 Assembly Object Instance 154, 0x9A Data Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Setpoint	RefFrom Net	CtrlFromNet	Ready	SCR AC In Status	Running 1	Warning	Faulted
1	INPUT1 Discrete	Summary Limiting	Max Duty Cycle	Output Enable	Relay State	RefFrom Analog	RefFrom Local	CtrlFrom Local
2	*Value of parameter pointed to by AssyWord0 Param (Low Byte)							
3	*Value of parameter pointed to by AssyWord0 Param (High Byte)							
4	*Value of parameter pointed to by AssyWord1 Param (Low Byte)							
5	*Value of parameter pointed to by AssyWord1 Param (High Byte)							
6	*Value of parameter pointed to by AssyWord2 Param (Low Byte)							
7	*Value of parameter pointed to by AssyWord2 Param (High Byte)							
8	*Value of parameter pointed to by AssyWord3 Param (Low Byte)							
9	*Value of parameter pointed to by AssyWord3 Param (High Byte)							
10	*Value of parameter pointed to by AssyWord4 Param (Low Byte)							
11	*Value of parameter pointed to by AssyWord4 Param (High Byte)							
12	*Value of parameter pointed to by AssyWord5 Param (Low Byte)							
13	*Value of parameter pointed to by AssyWord5 Param (High Byte)							
14	*Value of parameter pointed to by AssyWord6 Param (Low Byte)							
15	*Value of parameter pointed to by AssyWord6 Param (High Byte)							
16	*Value of parameter pointed to by AssyWord7 Param (Low Byte)							
17	*Value of parameter pointed to by AssyWord7 Param (High Byte)							
18	*Value of parameter pointed to by AssyWord8 Param (Low Byte)							
19	*Value of parameter pointed to by AssyWord8 Param (High Byte)							
20	*Value of parameter pointed to by AssyWord9 Param (Low Byte)							
21	*Value of parameter pointed to by AssyWord9 Param (High Byte)							
22	*Value of parameter pointed to by AssyWord10 Param (Low Byte)							
23	*Value of parameter pointed to by AssyWord10 Param (High Byte)							

*** BOOL and USINT parameters are filled with leading zeros to fit two bytes. UDINT parameters have no defined result, but are all available as split UINT parameters.**

The following table indicates the I/O Assembly Data Attribute mapping for Input Assemblies:

Table 55 Assembly Data Attribute Mapping for Input Assemblies

Data Component Name	Class		Instance Number	Attribute		
	Name	Number		Name	Number	Type
Faulted	SCR Control Supervisor	$8D_{hex}$	1	Faulted	10	BOOL
Warning	SCR Control Supervisor	$8D_{hex}$	1	Warning	11	BOOL
Running1	SCR Control Supervisor	$8D_{hex}$	1	Running1	7	BOOL
SCR AC In Status	SCR Controller	$A1_{hex}$	1	SCR AC In Status	6	BOOL
Ready	SCR Control Supervisor	$8D_{hex}$	1	Ready	9	BOOL
CtrlFromNet	SCR Control Supervisor	$8D_{hex}$	1	CtrlFromNet	15	BOOL
RefFromNet	SCR Controller	65_{hex}	1	RefFromNet	2	BOOL
At Setpoint	SCR Controller	65_{hex}	1	At Setpoint	3	BOOL
CtrlFromLocal	SCR Controller	65_{hex}	1	CtrlFromLocal	7	BOOL
RefFromLocal	SCR Controller	65_{hex}	1	RefFromLocal	8	BOOL
RefFromAnalog	SCR Controller	65_{hex}	1	RefFromAnalog	9	BOOL
Relay State	SCR Controller	65_{hex}	1	Relay State	15	BOOL
Output Enable	SCR Controller	65_{hex}	1	Output Enable	16	BOOL
Max Duty Cycle	SCR Controller	65_{hex}	1	Max Duty Cycle	11	BOOL
Summary Limiting	SCR Controller	65_{hex}	1	Summary Limiting	10	BOOL
INPUT1 Discrete	SCR Controller	65_{hex}	1	INPUT1 Discrete	139	BOOL

The following common services are implemented for the Assembly Object.

Table 56 Assembly Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes*	Set_Attribute_Single

*Set_Attribute_Single only applies to Output Assembly Instances.

Connection Object – Class Code 0x05

The following class attributes are supported for the Connection Object:

Table 57 Connection Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1

The following instance 1 (M/S Explicit Message Connection) attributes are supported.

Object Instance	Connection Type	Maximum Connection Instances		
	M/S Explicit Message	Server	Client	Total
Complete this section for Dynamic I/O connections	I/O Production trigger(s)	Cyclic [ ]	COS [ ]	App. Trig. [ ]
	Transport type(s)	Server [x]		Client [ ]
	Transport class(es)	0 [ ]	2 [ ]	3 [x]

Table 58 Connection Object Instance 1 Attributes (M/S Explicit Message Connection)

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0 = Nonexistent 1 = Configuring 3 = Established 4 = Timed Out
2	Get	Instance Type	USINT	0 = Explicit message
3	Get	Transport Class Trigger	BYTE	0x83 (Class 3 Server)
4	Get	Produced Connection ID	UINT	10xxxxxx011 Xxxxxx = Note address
5	Get	Consumed Connection ID	UINT	10xxxxxx100 Xxxxxx = Node Address
6	Get	Initial Comm Characteristics	BYTE	0x22
7	Get	Produced Connection Size	UINT	0x61
8	Get	Consumed connection Size	UINT	0x61
9	Get/Set	Expected Packet Rate	UINT	In ms
12	Get	Watchdog Action	USINT	1 = Auto delete 3 = Deferred delete
13	Get	Produced Connection Path Length	UINT	0
14	Get	Produced Connection Path		Null (no data)
15	Get	Consumed Connection Path Length	UINT	0
16	Get	Consumed Connection Path		Null (no data)
17	Get	Production Inhibit Time	UINT	0

The following instance 2 (M/S Poll Connection) attributes are supported.

Object Instance	Connection Type	Maximum Connection Instances					
	M/S Poll	1	Server		Client	1	Total

Complete this section for Dynamic I/O connections	I/O Production trigger(s)	Cyclic		COS		App. Trig.	x
	Transport type(s)	Server	x			Client	
	Transport class(es)	0		2		3	x

Table 59 Connection Object Instance 2 Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0 = Nonexistent 1 = Configuring 3 = Established 4 = Timed Out
2	Get	Instance Type	USINT	1 = I/O message
3	Get	Transport Class Trigger	BYTE	If alloc choice = polled OR If alloc choice = !polled && !ack suppressed: 0x80 (Server Class 0)
4	Get	Produced Connection ID	UINT	01111xxxxxx Xxxxxx = Node address
5	Get	Consumed Connection ID	UINT	10xxxxxx101 Xxxxxx = Node address
7	Get	Produced Connection Size	UINT	0…8
8	Get	Consumed connection Size	UINT	0…8
9	Get/Set	Expected Packet Rate	UINT	In ms
12	Get	Watchdog Action	USINT	0 = Transition to timed out 1 = Auto delete 2 = Auto reset
13	Get	Produced Connection Path Length	UINT	8
14	Get/Set	Produced Connection Path	EPATH	21 04 00 25 (assy. Inst.) 00 30 03
15	Get	Consumed Connection Path Length	UINT	8
16	Get/Set	Consumed Connection Path	EPATH	21 04 00 25 (assy. Inst.) 00 30 03
17	Get/Set	Production Inhibit Time	UINT	0

The following instances 5…7 (Group 3 Explicit Message Connections Allocated through UCMM) are supported:

Object Instance	Connection Type	Maximum Connection Instances
	Peer Explicit Message	3 Server Client 3 Total

Complete this section for Dynamic I/O connections	I/O Production trigger(s)	Cyclic		COS		App. Trig.	
	Transport type(s)	Server	x			Client	
	Transport class(es)	0		2		3	x

Table 60 Connection Object Instances 5…7 Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0 = Nonexistent 1 = Configuring 3 = Established 4 = Timed Out
2	Get	Instance Type	USINT	0 = Explicit Message
3	Get	Transport Class Trigger	BYTE	0x83 – Server, Transport Class 3
4	Get	Produced Connection ID	UINT	Depends on message group and message ID
5	Get	Consumed Connection ID	UINT	Depends on message group and message ID
6	Get	Initial Comm Characteristics	BYTE	0x33 (Group 3)
7	Get	Produced Connection Size	UINT	
8	Get	Consumed connection Size	UINT	
9	Get/Set	Expected Packet Rate	UINT	In ms
12	Get/Set	Watchdog Action	USINT	01 = Auto delete 03 = Deferred delete
13	Get	Produced Connection Path Length	UINT	0
14	Get	Produced Connection Path		Empty
15	Get	Consumed Connection Path Length	UINT	0
16	Get	Consumed Connection Path		Empty
17	Get	Production Inhibit Time	UINT	0

The following instances 8 (Peer Dynamic Message) is supported:

Object Instance	Connection Type	Maximum Connection Instances					
	Peer Dynamic Message	1	Server		Client	1	Total

Complete this section for Dynamic I/O connections	I/O Production trigger(s)	Cyclic	x		COS	x	App. Trig.	x
	Transport type(s)	Server	x				Client	x
	Transport class(es)	0	x		2	x	3	x

Table 61 Connection Object Instances 8 Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	
2	Get	Instance Type	USINT	
3	Get/Set	Transport Class Trigger	BYTE	
4	Get/Set	Produced Connection ID	UINT	
5	Get/Set	Consumed Connection ID	UINT	
6	Get/Set	Initial Comm Characteristics	BYTE	
7	Get	Produced Connection Size	UINT	
8	Get	Consumed connection Size	UINT	
9	Get/Set	Expected Packet Rate	UINT	
12	Get	Watchdog Action	USINT	
13	Get	Produced Connection Path Length	UINT	
14	Get/Set	Produced Connection Path		
15	Get	Consumed Connection Path Length	UINT	
16	Get/Set	Consumed Connection Path		
17	Get/Set	Production Inhibit Time	UINT	

The following common services are implemented for the Connection Object:

Table 62 Connection Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x05	No	Yes	Reset (Connection Object Only)
0x08	Yes	No	Create
0x09	No	Yes	Delete
0x0D	No	Yes*	Apply
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

*Yes only applies to Peer Explicit or Peer Dynamic Messages.

SCR Controller Object – Class Code 0x65

The following class attributes are supported for the SCR Controller Object.

Table 63 SCR Controller Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instance	UINT	1

A single instance of the SCR Controller Object is supported. The following instance attributes are supported.

Table 64 SCR Controller Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Min/Max	Default	Description
1	Get/Set	NetRef	BOOL	0,1	0	See definition section
2	Get	RefFromNet	BOOL	0,1	0	See definition section
3	Get	At Setpoint	BOOL	0,1	0	See definition section
4	Get/Set	Auto RegMode	USINT	0..6	1	See definition section
5	Get/Set	Net Setpoint%	UINT	0..125.00	0	See definition section
6	Get	SCR AC In Status	BOOL	0,1	0	See definition section
7	Get	CtrlFromLocal	BOOL	0,1	0	See definition section
8	Get	RefFromLocal	BOOL	0,1	0	See definition section
9	Get	RefFromAnalog	BOOL	0,1	0	See definition section
10	Get	Summary Limiting	BOOL	0,1	0	See definition section
11	Get	Max Duty Cycle	BOOL	0,1	0	See definition section
12	Get/Set	Remote Relay Req	BOOL	0,1	0	See definition section
13	Get/Set	NetKW Hour Reset	BOOL	0,1	0	See definition section
14	Get/Set	Net PFZF Select	BOOL	0,1	0	See definition section
15	Get	Relay State	BOOL	0,1	0	See definition section
16	Get	Enable Output	BOOL	0,1	0	See definition section
17	Get/Set	DAC Out1 Ref	UINT	0..65535	0	See definition section
18	Get/Set	DAC Out2 Ref	UINT	0..65535	0	See definition section
19	Get/Set	DAC Out3 Ref	UINT	0..65535	0	See definition section
20	Get	Iin Actual Peak%	UINT	0..6553.5	0.0	See definition section
21	Get	Iin Actual RMS	UINT	0..6553.5	0.0	See definition section
22	Get	Iin Actual RMS%	UINT	0..6553.5	0.0	See definition section
23	Get	Vin Actual RMS	UINT	0..6553.5	0.0	See definition section
24	Get	Vin Actual RMS%	UINT	0..6553.5	0.0	See definition section
25	Get	KVAin Actual	UINT	0..6553.5	0.0	See definition section
26	Get	KVAin Actual%	UINT	0..6553.5	0.0	See definition section
27	Get	Iout Actual RMS	UINT	0..6553.5	0.0	See definition section
28	Get	Iout Actual RMS%	UINT	0..6553.5	0.0	See definition section
29	Get	Vout Actual RMS	UINT	0..6553.5	0.0	See definition section
30	Get	Vout Actual RMS%	UINT	0..6553.5	0.0	See definition section
31	Get	KWout Actual	UINT	0..6553.5	0.0	See definition section
32	Get	KWout Actual%	UINT	0..6553.5	0.0	See definition section
33	Get	Ambient Temp C	INT	-40..125	0	See definition section
34	Get	Frequency Actual	UINT	0.0..70.0	0.0	See definition section
35	Get	Nom Input Freq	UINT	50.0, 60.0	60.0	See definition section

36	Get	Power Factor	UINT	0.00..1.00	0.00	See definition section
37	Get	Resistance Ratio	UINT	0..65535	0	See definition section
38	Get	Status Auxiliary	WORD	0..65535	0	See definition section
39	Get	Conductance%	UINT	0..6553.5	0.0	See definition section
40	Get	Limit Bit Status	WORD	0..15	0	See definition section
41	Get	Setpoint Actual%	UINT	0..655.35	0.00	See definition section
42	Get	Reg Mode Actual	UINT	1..6	1	See definition section
43	Get	DutyCycle Actual	UINT	0..655.35	0.00	See definition section
44	Get	DAC Out1 Actual	UINT	0..65535	0	See definition section
45	Get	DAC Out2 Actual	UINT	0..65535	0	See definition section
46	Get	DAC Out3 Actual	UINT	0..65535	0	See definition section
47	Get/Set	FiringModeActual	UINT	0..8	0	See definition section
48	Get	Local Setpoint%	UINT	0..125.00	0.00	See definition section
49	Get	Local RegMode	UINT	0..6	0	See definition section
50	Get	Control Time On	UDINT	0..4294967.295	0.000	See definition section
51	Get	Control Time Lsb	UINT	0..65535	0	See definition section
52	Get	Control Time Msb	UINT	0..65535	0	See definition section
53	Get	Output Time On	UDINT	0..4294967.295	0.000	See definition section
54	Get	Output Time Lsb	UINT	0..65535	0	See definition section
55	Get	Output Time Msb	UINT	0..65535	0	See definition section
56	Get	KW-hour Meter	UDINT	0..429496729.5	0.0	See definition section
57	Get	KW-hour Lsb	UINT	0..65535	0	See definition section
58	Get	KW-hour Msb	UINT	0..65535	0	See definition section
59	Get	KVAin Rating	UINT	1.8..720.0	28.8	See definition section
60	Get	KWout Rating	UINT	1.8..720.0	28.8	See definition section
61	Get/Set	Vin PT Primary	UINT	60..600	480	See definition section
62	Get/Set	Vout PT Primary	UINT	60..600	480	See definition section
63	Get/Set	Current XFMR Cnt	UINT	1, 2	1	See definition section
64	Get/Set	Iin XFMR Ratng	UINT	30..1200	60	See definition section
65	Get/Set	Iout XFMR Ratng	UINT	30..1200	60	See definition section
66	Get/Set	Auto RegMode NV	USINT	1..6	1	See definition section
67	Get/Set	AutoRun	BOOL	0, 1	1	See definition section
68	Get/Set	Invert Discretes	WORD	0..0xFFFF	0x0000	See definition section
69	Get/Set	Iin RMS% Limit	UINT	0..150	110	See definition section
70	Get/Set	Vout RMS% Limit	UINT	0..125	110	See definition section
71	Get/Set	Iout RMS% Limit	UINT	0..150	110	See definition section
72	Get/Set	KW Output% Limit	UINT	0..125	110	See definition section
73	Get/Set	Vout Prop Gain	UINT	0..25	10	See definition section
74	Get/Set	Vout Integ Gain	UINT	0..25	10	See definition section
75	Get/Set	Iout Prop Gain	UINT	0..25	10	See definition section
76	Get/Set	Iout Integ Gain	UINT	0..25	10	See definition section
77	Get/Set	KWout Prop Gain	UINT	0..25	10	See definition section
78	Get/Set	KWout Integ Gain	UINT	0..25	10	See definition section
79	Get/Set	Resist Prop Gain	UINT	0..25	10	See definition section
80	Get/Set	Resist Int Gain	UINT	0..25	10	See definition section
81	Get/Set	ExtFB Prop Gain	UINT	0..25	10	See definition section
82	Get/Set	ExtFB Integ Gain	UINT	0..25	10	See definition section
83	Get/Set	Iin Prop Gain	UINT	0..25	10	See definition section
84	Get/Set	Iin Integ Gain	UINT	0..25	10	See definition section
85	Get/Set	Vin High%	UINT	25..150	125	See definition section
86	Get/Set	Vin Low%	UINT	25..100	85	See definition section
87	Get/Set	Iin PeakFault%	UINT	0..300	0	See definition section
88	Get/Set	Iin Peak Retry	UINT	0..8	0	See definition section

89	Get/Set	Iin Peak Timer	UINT	10..600	10	See definition section
90	Get/Set	Iin RMS OL%	UINT	0..200	125	See definition section
91	Get/Set	Iin RMS OL Timer	UINT	10..600	10	See definition section
92	Get/Set	Res Ratio High	UINT	0..65535	10000	See definition section
93	Get/Set	Res Ratio Low	UINT	0..65535	0	See definition section
94	Get/Set	Freq Deviation	UINT	1..4	4	See definition section
95	Get/Set	Ambient OT Limit	UINT	0..85	75	See definition section
99	Get/Set	Ramp Up Time	UINT	0..360	2	See definition section
100	Get/Set	Ramp Down Time	UINT	0..360	2	See definition section
101	Get/Set	Firing Mode Sel	UINT	0..5	0	See definition section
102	Get/Set	PFZF Dly Time(r)	UINT	10..9999	360	See definition section
103	Get/Set	ZFT SPC Selector	BOOL	0, 1	0	See definition section
104	Get/Set	ZFT Walk Up Time	UINT	3..10	10	See definition section
105	Get/Set	ZFT Rep Cycle%	UINT	10..90	50	See definition section
106	Get/Set	Slew Rate Limit	UINT	3..1000	10	See definition section
107	Get/Set	DAC Out1 FS	UINT	16383..65535	65535	See definition section
108	Get/Set	DAC Out2 FS	UINT	16383..65535	65535	See definition section
109	Get/Set	DAC Out3 FS	UINT	16383..65535	65535	See definition section
110	Get/Set	DAC Out1 Select	UINT	0..11	4	See definition section
111	Get/Set	DAC Out2 Select	UINT	0..11	5	See definition section
112	Get/Set	DAC Out3 Select	UINT	0..11	6	See definition section
113	Get/Set	Modbus A Addr	UINT	1..247	1	See definition section
114	Get/Set	ABaud Rate	UINT	1..3	3	See definition section
115	Get/Set	AParity/StopBits	UINT	1, 2	2	See definition section
116	Get/Set	Modbus B Addr	UINT	1..247	1	See definition section
117	Get/Set	BBaud Rate	UINT	1..3	3	See definition section
118	Get/Set	BParity/StopBits	UINT	1, 2	2	See definition section
126	Get/Set	Reserved	BOOL	0, 1	0	See definition section
127	Get	ARtnBusMsgCt	UINT	0..65535	0	See definition section
128	Get	ARtnBusComErrCt	UINT	0..65535	0	See definition section
129	Get	ARtnSlaveExErrCt	UINT	0..65535	0	See definition section
130	Get	ARtnSlaveMsgCt	UINT	0..65535	0	See definition section
131	Get	ARtnSlaveNoRspCt	UINT	0..65535	0	See definition section
132	Get	AbuffOverflowCt	UINT	0..65535	0	See definition section
133	Get	BRtnBusMsgCt	UINT	0..65535	0	See definition section
134	Get	BRtnBusComErrCt	UINT	0..65535	0	See definition section
135	Get	BRtnSlaveExErrCt	UINT	0..65535	0	See definition section
136	Get	BRtnSlaveMsgCt	UINT	0..65535	0	See definition section
137	Get	BRtnSlaveNoRspCt	UINT	0..65535	0	See definition section
138	Get	BbuffOverflowCt	UINT	0..65535	0	See definition section
139	Get	INPUT1 Discrete	BOOL	0, 1	0	See definition section
200	Get	VinRMS Unscaled	UINT	0..65535	0	See definition section
201	Get/Set	Vin CAL ZERO	UINT	0..100	0	See definition section
202	Get/Set	Vin CAL SPAN	UINT	2047..8190	4095	See definition section
203	Get	VoutRMS Unscaled	UINT	0..65535	0	See definition section
204	Get/Set	Vout CAL ZERO	UINT	0..100	0	See definition section
205	Get/Set	Vout CAL SPAN	UINT	2047..8190	4095	See definition section
206	Get	IinRMS Unscaled	UINT	0..65535	0	See definition section
207	Get/Set	Iin CAL ZERO	UINT	0..100	0	See definition section
208	Get/Set	Iin CAL SPAN	UINT	2047..8190	4095	See definition section
209	Get	IoutRMS Unscaled	UINT	0..65535	0	See definition section
210	Get/Set	Iout CAL ZERO	UINT	0..100	0	See definition section
211	Get/Set	Iout CAL SPAN	UINT	2047..8190	4095	See definition section

212	Get	KWout Unscaled	UINT	0..65535	0	See definition section
213	Get/Set	KWout CAL ZERO	UINT	0..100	0	See definition section
214	Get/Set	KWout CAL SPAN	UINT	2047..8190	4095	See definition section
215	Get	Conduct Unscaled	UINT	0..65535	0	See definition section
216	Get/Set	Conduct CAL ZERO	UINT	0..100	0	See definition section
217	Get/Set	Conduct CAL SPAN	UINT	2047..8190	4095	See definition section
218	Get	ADC Setpoint Raw	UINT	0..65535	0	See definition section
219	Get/Set	ADC Setpt Zero	UINT	0..10000	2500	See definition section
220	Get/Set	ADC Setpt Span	UINT	819..20475	4095	See definition section
221	Get	Analog Setpoint%	INT	-327.68..327.67	0.00	See definition section
222	Get	ADC Feedbck Raw	UINT	0..65535	0	See definition section
223	Get/Set	ADC Feedbck Zero	UINT	0..10000	2500	See definition section
224	Get/Set	ADC Feedbck Span	UINT	819..20475	4095	See definition section
225	Get	Analog Feedback%	INT	-327.68..327.67	0.00	See definition section

The following common services are implemented for the SCR Controller Object.

Table 65 SCR Controller Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

SCR Control Supervisor Object – Class Code 0x8D

The following class attributes are supported for the SCR Control Supervisor Object.

Table 66 SCR Control Supervisor Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instance	UINT	1

A single instance of the SCR Control Supervisor Object is supported. The following instance attributes are supported.

Table 67 SCR Control Supervisor Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Min/Max	Default	Description
3	Get/Set	Run1	BOOL	0,1	0	See Run/Stop Event Matrix
5	Get/Set	NetCtrl	BOOL	0,1	0	Requests Run/Stop control to be from local or from network. 0 = Local, 1 = Network (See CtrlFromNet)
7	Get	Running1	BOOL	0,1	0	0 = SCR gates off 1 = SCR gates enabled
9	Get	Ready	BOOL	0,1	0	1 = Ready 0 = Not ready
10	Get	Faulted	BOOL	0,1	0	1 = Faulted (latched) 0 = Not faulted
11	Get	Warning	BOOL	0,1	0	1 = Warning 0 = No warnings
12	Get/Set	FaultRst	BOOL	0,1	0	0->1 = Fault reset 0 = No action
15	Get	CtrlFromNet	BOOL	0,1	0	Status of Run/Stop control source. 0 = Control is local 1 = Control is from network
16	Get/Set	NetFaultMode	USINT	0..2	1	Action on loss of CIP Network. See Advanced Setup Group definitions.
17	Get/Set	ForceFault Trip	BOOL	0,1	0	0->1 Force fault trip
20	Get/Set	NetIdleMode	USINT	0..2	1	Mode on reception of CIP communication IDLE event. See Advanced Setup Group definitions.

100	Get	Internal Exc	WORD	0..65535	0	See Monitor Parameters Group Definitions
101	Get	Warning Status	WORD	0..65535	0	
102	Get	Fault Status	WORD	0..65535	0	
103	Get	Relay Status	WORD	0..65535	0	
104	Get/Set	Warning Mask	WORD	0..65535	0x0004	See Advanced Setup Group Definitions
105	Get/Set	Fault Mask	WORD	0..65535	0x4002	
106	Get/Set	Relay Mask	WORD	0..65535	0x0100	
107	Get	WarnCode	UINT	0..15	15	See Monitor Parameters Group Definitions
108	Get	FaultCode	UINT	0..15	15	
109	Get	RelayCode	UINT	0..15	15	
120	Get/Set	Log Config	UINT	0,1	0	See Event Log Group Definitions
121	Get	Log Count	UINT	0..65535	0	
122	Get	Log Last ID	UINT	0..65535	0	
123	Get	Log Last Time	UDINT	0.. 4294967. 295	0.000	
124	Get	Log Last T Lsb	UINT	0..65535	0	
125	Get	Log Last T Msb	UINT	0..65535	0	
126	Get	Log Last Event	UINT	0..65535	0	
127	Get	Log Last Data1	UINT	0..65535	0	
128	Get	Log Last Data2	UINT	0..65535	0	
129	Get	Log Last Data3	UINT	0..65535	0	
130	Get/Set	Log View ID REQ	UINT	0..65535	0	
131	Get	Log View ID	UINT	0..65535	0	
132	Get	Log View Time	UDINT	0.. 4294967. 295	0.000	
133	Get	Log View T Lsb	UINT	0..65535	0	
134	Get	Log View T Msb	UINT	0..65535	0	
135	Get	Log View Event	UINT	0..65535	0	
136	Get	Log View Data1	UINT	0..65535	0	
137	Get	Log View Data2	UINT	0..65535	0	
138	Get	Log View Data3	UINT	0..65535	0	

The following common services are implemented for the SCR Control Supervisor Object.

Table 68 SCR SCR Control Supervisor Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single
0x05	No	Yes	Reset (SCR Control Supervisor and SCR Controller only)

DeviceNet Interface Object – Class Code 0xAE

The following class attributes are supported for the DeviceNet Interface Object.

Table 69 DeviceNet Interface Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instance	UINT	1

A single instance of the DeviceNet Interface Object is supported. The following instance attributes are supported.

Table 70 DeviceNet Interface Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Min/Max	Default	Description
2	Get	ZeroWord	UINT	0	0	Returns zero
3	Get	Firmware Rev	UINT	0..65.535	0.000	Firmware Revision in EDS viewable format
4	Get	MAC ID Switch	USINT	0..99	63	MAC ID Switch Value
5	Get	Baud Switch	USINT	0..9	0	Baud Switch Value
6	Get	NV_Dnet_MAC_ID	USINT	0..63	63	Stored value of MAC ID
7	Get	NV_Dnet_BAUD	USINT	0..2	0	Stored value of baud rate
8	Get/Set	AssyWord0 Param	USINT	1..223	11	Parameter numbers whose value is used as the nth word in programmable Input Assemblies
9	Get/Set	AssyWord1 Param	USINT	1..223	9	
10	Get/Set	AssyWord2 Param	USINT	1..223	13	
11	Get/Set	AssyWord3 Param	USINT	1..223	10	
12	Get/Set	AssyWord4 Param	USINT	1..223	8	
13	Get/Set	AssyWord5 Param	USINT	1..223	12	
14	Get/Set	AssyWord6 Param	USINT	1..223	5	
15	Get/Set	AssyWord7 Param	USINT	1..223	4	
16	Get/Set	AssyWord8 Param	USINT	1..223	18	
17	Get/Set	AssyWord9 Param	USINT	1..223	3	
18	Get/Set	AssyWord10 Param	USINT	1..223	2	
20	Get/Set	Program Lock	USINT	0..5	0	Lock level to lock writes to designated parameters.
21	Get/Set	Output Assembly	USINT	102,103,104	102	Output Assembly instance that is the power-up/reset default
22	Get/Set	Input Assembly	USINT	151,152,153,154	152	Input Assembly instance that is the power-up/reset default

The following common services are implemented for the DeviceNet Interface Object.

Table 71 DeviceNet Interface Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Appendix C Tip - Handling of Attribute Values Beyond the Min and Max Values

Attributes have Min and Max values listed with the definitions. If data outside the Min and Max values are written to an attribute, the response is dependent on the communication method.

If RSNetWorx is used during configuration, RSNetWorx will honor the Min and Max values in the EDS and will not attempt to send a message with an improper value. It will issue a warning that the user must revise the value. Generally, if DeviceNet explicit messaging is used, writing an improper value will result in an error response reply coded for an invalid attribute value.

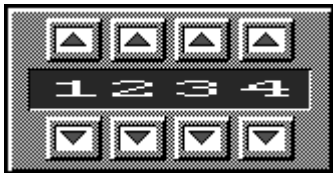
If a Modbus Master HMI panel, or Modbus computer program is used, the designer has the option of applying error filters using the published Min and Max values. This is recommended.

Attribute values written using DeviceNet I/O messaging using Output Assemblies and Modbus serial port write functions will not generate any error messages for data values. If a value exceeds the Min and Max value for a given attribute, one of two methods will be applied.

Discard – The first method is to discard invalid data. This is the most common method used.

Clamp – The second method is to clamp the invalid data an the Min and Max value. For attributes suitable for this method, it can simplify the control or HMI systems used to write to attributes. All attributes using this method are unsigned 16-bit integers. Values exceeding the Max up to 32767 will be clamped at the Max value. Values from 32768 to 65535 are clamped at Min. If the Min is higher than zero, then values between 0 and Min are clamped at Min. Net Setpoint% is the only DeviceNet I/O assembly member using this Clamp method. This mostly affects Modbus messaging.

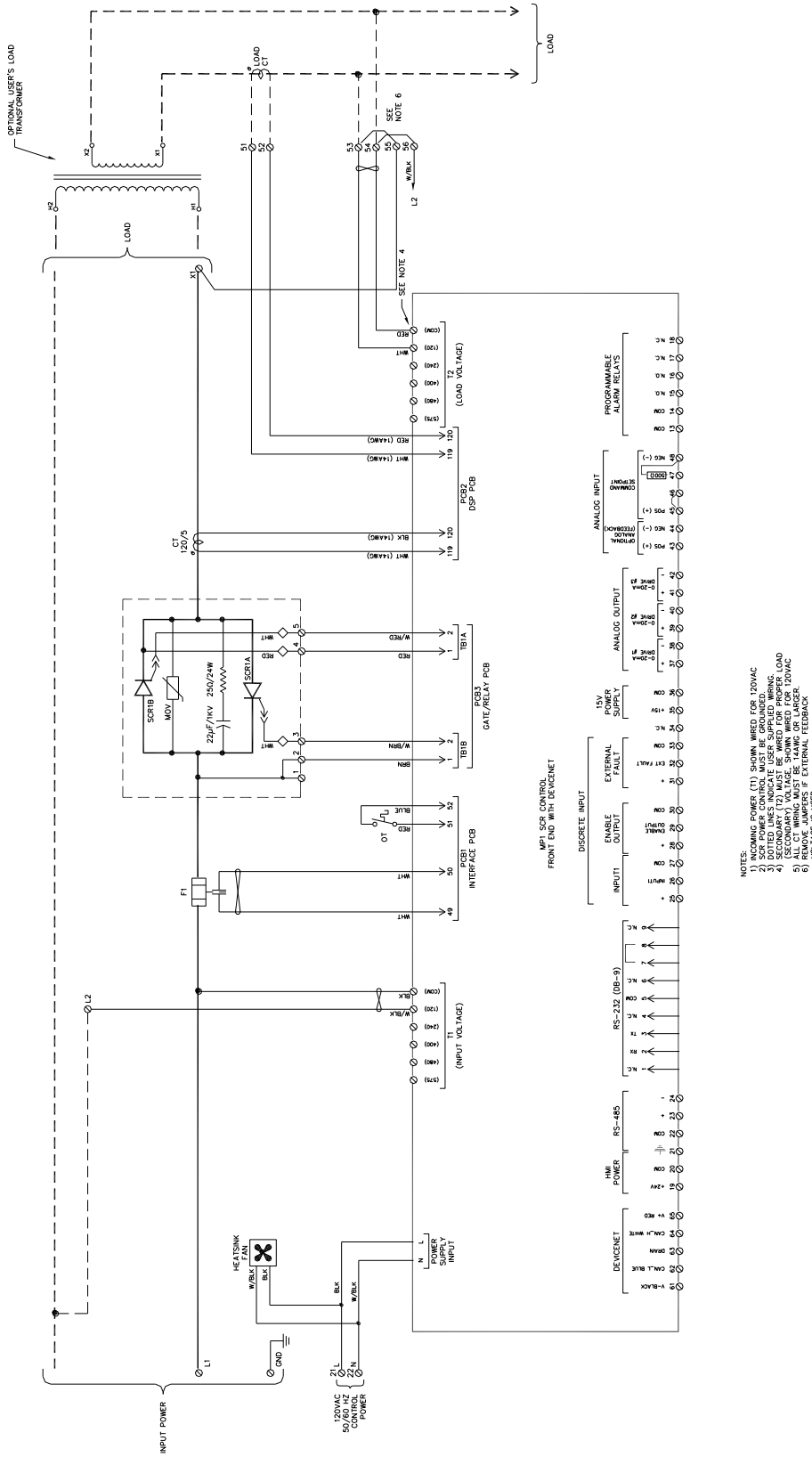
The intent is to allow simple HMI screen controls such as this to be used conveniently. Clamping allows decade increments and decrements to overshoot and undershoot the Min and Max with clamping at the Min and Max values.



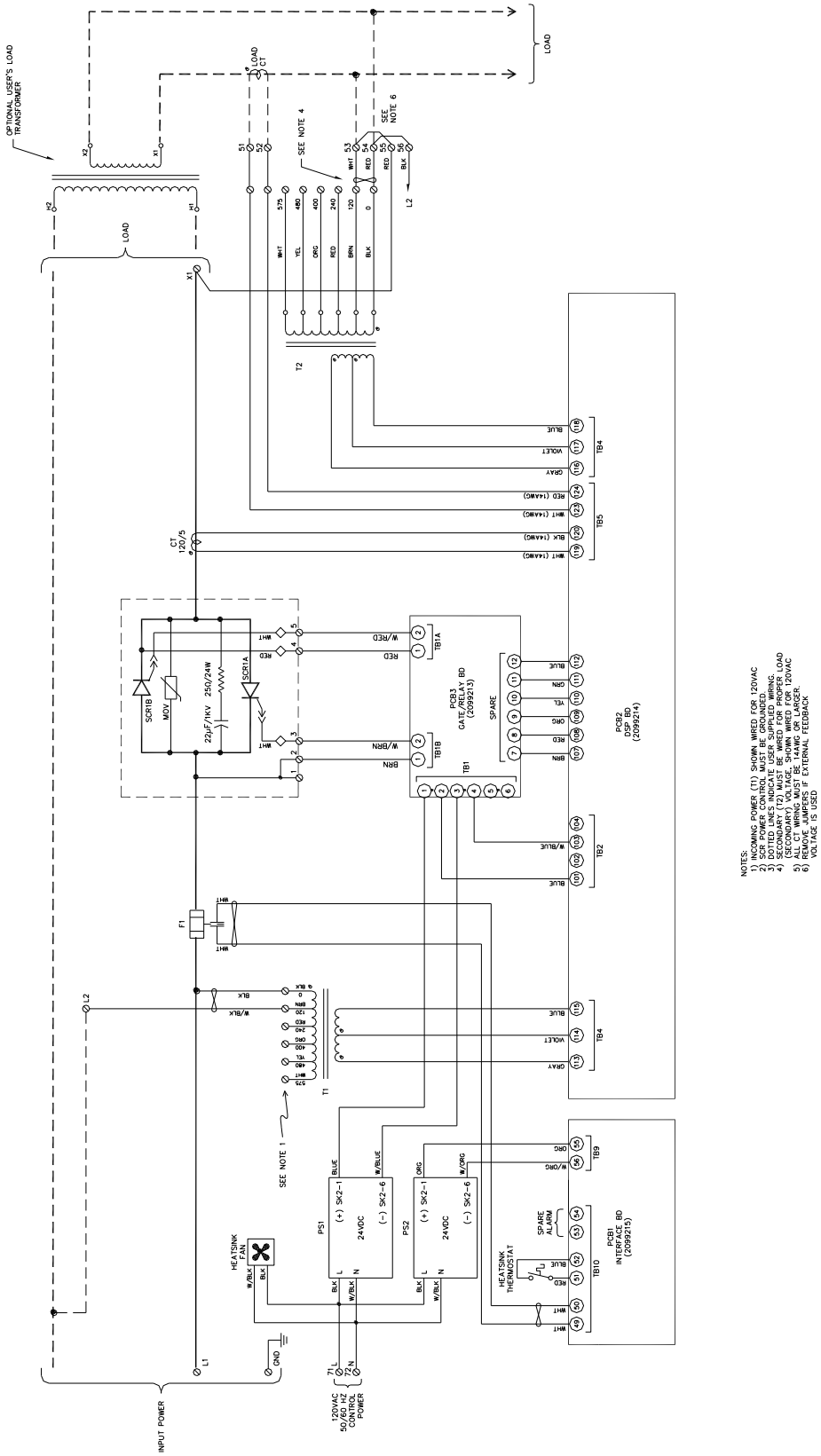
Only the following attributes use the Clamp method. Any control panel part or tag programmed to utilize this clamping capability must be tested with the full range of values that may be transmitted.

SCR Assy Data Group	Limits Setup Group	Alarm Setup Group	Calibration Group
58 ZFT Walk Up Time	51 Iin RMS% Limit	33 Vin High%	199 Vin CAL SPAN
59 ZFT Rep Cycle%	52 Vout RMS% Limit	34 Vin Low%	202 Vout CAL SPAN
60 Slew Rate Limit	53 Iout RMS% Limit	35 Iin PeakFault%	205 Iin CAL SPAN
	54 KW Output% Limit	37 Iin Peak Timer	208 Iout CAL SPAN
		38 Iin RMS OL%	211 KWout CAL SPAN
Monitor Parameters Group		39 Iin RMS OL Timer	214 Conduct CAL SPAN
183 Local Setpoint%		43 Ambient OT Limit	216 ADC Setpt Zero
Only Modbus ports may write to Local Setpoint%.			217 ADC Setpt Span
			220 ADC Feedbck Zero
			221 ADC Feedbck Span

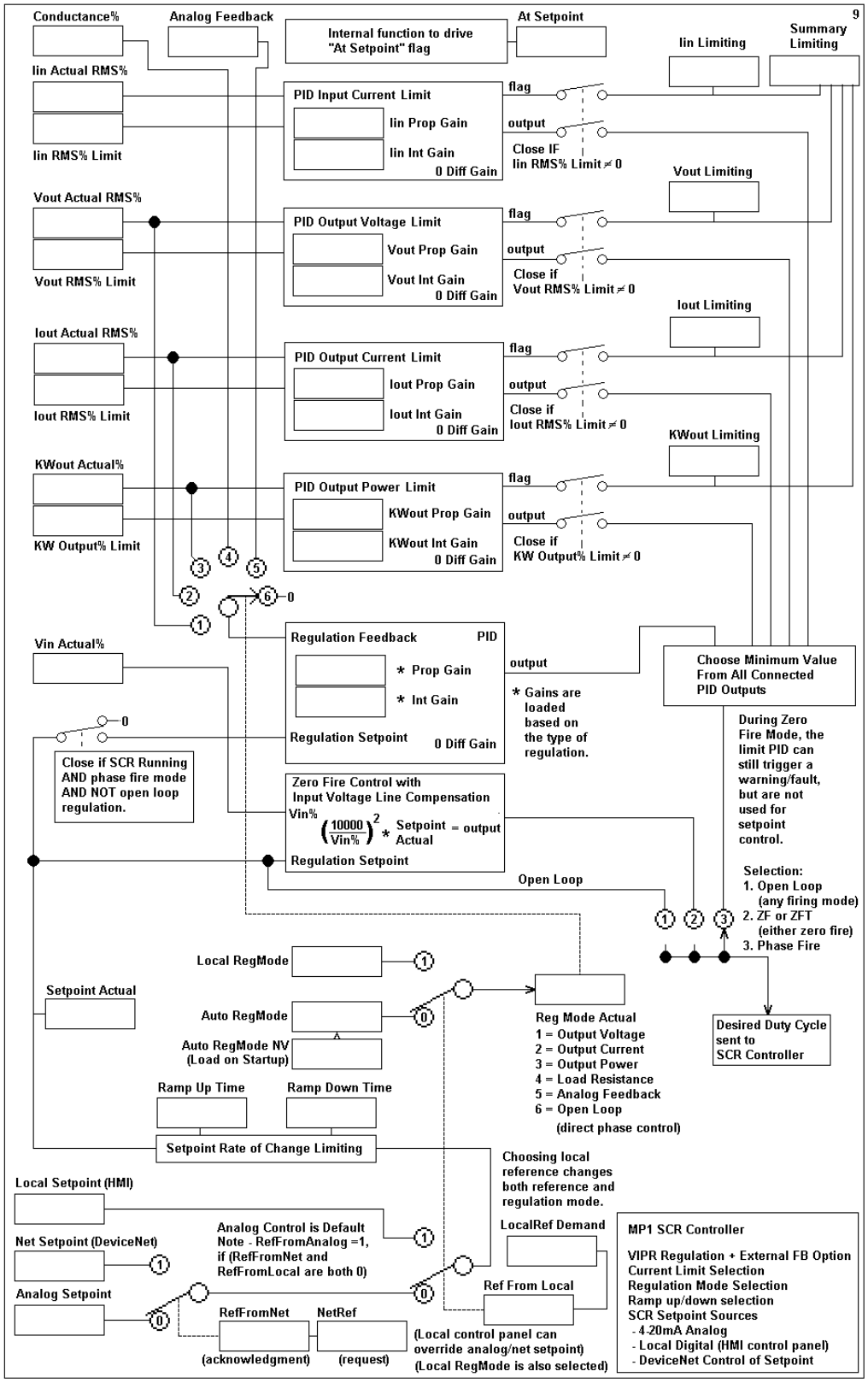
Appendix D Schematic – Wiring of MP1 SCR DeviceNet Head to SCR Assembly



Schematic – Detail Wiring of MP1 SCR DeviceNet Head to SCR Assembly



Setpoint Control / PI Regulation Mode / Limiting Diagram



Appendix E Modbus Register List

40001	Coils 1-16
40002	Coils 17-32
40003	Coils 33-48
40004	Coils 49-64
40005	Auto RegMode
40006	Local RegModeC2
40007	Local Setpoint
40008	DAC Out1 Ref
40009	DAC Out2 Ref
40010	DAC Out3 Ref
40011	Iin Actual Peak
40012	Iin Actual RMS
40013	Iin Actual RMS%
40014	Vin Actual RMS
40015	Vin Actual RMS%
40016	KVAin Actual
40017	KVAin Actual%
40018	Iout Actual RMS
40019	Iout Actual RMS%
40020	Vout Actual RMS
40021	Vout Actual RMS%
40022	KWout Actual
40023	KWout Actual%
40024	Ambient Temp C
40025	Frequency Actual
40026	Nom Input Freq
40027	Power Factor
40028	Resistance Ratio
40029	--Factory Only--
40030	Conductance%
40031	Internal Exc
40032	Warning Status
40033	Fault Status
40034	Relay Status
40035	WarnCode
40036	FaultCode
40037	RelayCode
40038	Setpoint Actual%
40039	Reg Mode Actual
40040	DutyCycle Actual
40041	DAC Out1 Actual
40042	DAC Out2 Actual
40043	DAC Out3 Actual
40044	FiringModeActual
40045	Net Setpoint%
40046	Control Time Lsb
40047	Control Time Msb
40048	Output Time Lsb
40049	Output Time Msb
40050	KW-hour Lsb
40051	KW-hour Msb
40052	Log Count
40053	Last Entry ID
40054	Last Entry T Lsb
40055	Last Entry T Msb
40056	Last Entry Event
40057	Last Entry Data1
40058	Last Entry Data2
40059	Last Entry Data3
40060	Log View ID REQ
40061	Log View ID
40062	Log View T Lsb
40063	Log View T Msb
40064	Log View Event
40065	Log View Data1
40066	Log View Data2
40067	Log View Data3
40068	Log Config
40069	KVAin Rating
40070	KWout Rating
40071	Vin PT Primary
40072	Vout PT Primary
40073	Current XFMR Cnt
40074	Iin XFMR Ratng
40075	Iout XFMR Ratng
40076	Auto RegMode NV
40077	AutoRun
40078	Invert Discretes
40079	Iin RMS% Limit
40080	Vout RMS% Limit
40081	Iout RMS% Limit
40082	KW Output% Limit
40083	Vout Prop Gain
40084	Vout Integ Gain
40085	Iout Prop Gain
40086	Iout Integ Gain
40087	KWout Prop Gain
40088	KWout Integ Gain
40089	Resist Prop Gain
40090	Resist Int Gain
40091	ExtFB Prop Gain
40092	ExtFB Integ Gain
40093	Iin Prop Gain
40094	Iin Integ Gain
40095	Vin High%
40096	Vin Low%
40097	Iin PeakFault%
40098	Iin Peak Retry
40099	Iin Peak Timer
40100	Iin RMS OL%
40101	Iin RMS OL Timer
40102	Res Ratio High
40103	Res Ratio Low#
40104	Freq Deviation
40105	Ambient OT Limit
40106	Warning Mask
40107	Fault Mask
40108	Relay Mask
40109	Ramp up time
40110	Ramp down time
40111	Firing Mode Sel
40112	PFZF Time Delay
40113	ZFT SPC Selector
40114	ZFT Walk Up Time
40115	ZFT Rep Cycle%
40116	Slew Rate Limit
40117	DAC Out1 FS
40118	DAC Out2 FS
40119	DAC Out3 FS
40120	DAC Out1 Select
40121	DAC Out2 Select
40122	DAC Out3 Select
40123	NetFaultMode
40124	NetIdleMode
40125	Modbus A Addr
40126	Baud Rate
40127	Parity/StopBits
40128	Modbus B Addr
40129	Baud Rate
40130	Parity/StopBits
40131	Firmware Rev
40132	AssyWord0 Param
40133	AssyWord1 Param
40134	AssyWord2 Param
40135	AssyWord3 Param
40136	AssyWord4 Param
40137	AssyWord5 Param
40138	AssyWord6 Param
40139	AssyWord7 Param
40140	AssyWord8 Param
40141	AssyWord9 Param
40142	AssyWord10 Param
40143	Output Assembly
40144	Input Assembly
40145	--Factory Only--
40146	Program Lock
40147	VinRMS Unscaled
40148	Vin CAL ZERO
40149	Vin CAL SPAN
40150	VoutRMS Unscaled
40151	Vout CAL ZERO
40152	Vout CAL SPAN
40153	IinRMS Unscaled
40154	Iin CAL ZERO
40155	Iin CAL SPAN
40156	IoutRMS Unscaled
40157	Iout CAL ZERO
40158	Iout CAL SPAN
40159	KWout Unscaled
40160	KWout CAL ZERO
40161	KWout CAL SPAN
40162	Conduct Unscaled
40163	Conduct CAL ZERO
40164	Conduct CAL SPAN
40165	ADC Setpoint Raw
40166	ADC Setpt Zero
40167	ADC Setpt Span
40168	Analog Setpoint%
40169	ADC Feedbck Raw
40170	ADC Feedbck Zero
40171	ADC Feedbck Span
40172	Analog Feedback%
40173	--Factory Only--
40174	--Factory Only--
40175	--Factory Only--
40176	--Factory Only--
40177	--Factory Only--
40178	--Factory Only--
40179	--Factory Only--
40180	--Factory Only--
40181	--Factory Only--
40182	--Factory Only--
40183	--Factory Only--
40184	--Factory Only--
40185	--Factory Only--
40186	ARtnBusMsgCt
40187	ARtnBusComErrCt
40188	ARtnSlaveExErrCt

40189	ARtnSlaveMsgCt
40190	ARtnSlaveNoRspCt
40191	AbuffOverflowCt
40192	BRtnBusMsgCt
40193	BRtnBusComErrCt
40194	BRtnSlaveExErrCt
40195	BRtnSlaveMsgCt
40196	BRtnSlaveNoRspCt
40197	BbuffOverflowCt
40198	MAC ID Switch
40199	BAUD Switch
40200	NV Dnet MAC ID
40201	NV Dnet BAUD
40202	Product Code
40203	Status
40204	Serial Number Lsb
40205	Serial Number Msb
40206	Product Name 0-1
40207	Product Name 2-3
40208	Product Name 4-5
40209	Product Name 6-7

40210	Product Name 8-9
40211	Product Name 10-11
40212	Product Name 12-13
40213	Product Name 14-15
40214	Product Name 16-17
40215	Product Name 18-19
40216	Product Name 20-21
40217	Product Name 22-23
40218	Product Name 24-25
40219	Product Name 26-27
40220	Product Name 28-29
40221	Product Name 30-31
40222	State
40223	HMI-A Watchdog
40224	HMI-A System0
40225	HMI-A System1
40226	HMI-A System2
40227	HMI-A System3
40228	HMI-A System4
40229	HMI-A System5
40230	HMI-A System6

40231	HMI-A System7
40232	HMI-A System8
40233	HMI-A System9
40234	HMI-A System10
40235	HMI-A System11
40236	HMI-A System12
40237	HMI-A System13
40238	HMI-A System14
40239	HMI-A System15
40240	HMI-A System16
40241	HMI-A System17
40242	HMI-A System18
40243	HMI-A System19
40244	HMI-B Watchdog
40245	HMI-B System0
40246	HMI-B System1
40247	HMI-B System2
40248	HMI-B System3
40249	HMI-B System4
40250	HMI-B System5
40251	HMI-B System6

40252	HMI-B System7
40253	HMI-B System8
40254	HMI-B System9
40255	HMI-B System10
40256	HMI-B System11
40257	HMI-B System12
40258	HMI-B System13
40259	HMI-B System14
40260	HMI-B System15
40261	HMI-B System16
40262	HMI-B System17
40263	HMI-B System18
40264	HMI-B System19
40265	--Factory Only--
40266	Dnet Assy
40267	--Factory Only--

Notes:
Registers 40202-40222 and 40265 allow a local HMI to monitor limited DeviceNet Attributes. Get only.

Registers 40223-40265 are allocated to local HMI's. An HMI may Get/Set these registers. They contain no MP1 data and have no MP1 control functions.

Appendix F Modbus Coil List

1	Local Fault Rst
2	LocalCtrl
3	Local Run1
4	LocalRef Demand
5	KW Hour Reset
6	Local ForceFault
7	Local Relay Req
8	Reset SCR Contrl
9	Local Control NV
10	Local Setpt NV
11	PFZF Select
12	Reserved1
13	Reserved2
14	Reserved3
15	Reserved4
16	Reserved5

17	Faulted
18	Warning
19	Running1
20	SCR AC In Status
21	Ready
22	CntlFromNet
23	RefFromNet
24	At Setpoint
25	CtrlFromLocal
26	RefFromLocal
27	RefFromAnalog
28	Relay State
29	Enable Output
30	Max Duty Cycle
31	Summary Limiting
32	INPUT1 Discrete

33	Vin RMS High
34	Vin RMS Low
35	Iin Peak Fault
36	Iin Timed OL
37	Heatsink OT
38	SCRShort/OutOpen
39	SCR Short/w Amps
40	Freq Deviation
41	High Ambient
42	Fuse Switch Out
43	Load Res High
44	Load Res Low
45	--Factory Only--
46	--Factory Only--
47	Optional Intern Input
48	External Fault

49	Iin Limiting
50	Iout Limiting
51	Vout Limiting
52	KWout Limiting
53	Spare1
54	Spare2
55	Spare3
56	Spare4
57	Spare5
58	Spare6
59	Spare7
60	Spare8
61	Spare9
62	Spare10
63	Comm Fault
64	Comm Idle

Note:
Coils 1-16 are all Get/Set Controls.
Coils 17-64 are Get only monitoring attributes.

Index

Note: DeviceNet parameter names in index end with their parameter number in brackets [1].

AMETEK®
HDR POWER SYSTEMS

EC DECLARATION OF CONFORMITY

WE: **AMETEK HDR POWER SYSTEMS**
503 Lakeview Plaza Blvd, Ste C
Worthington, Ohio, 43085 - USA

Declare under our sole responsibility that the products listed below and bearing the CE label:

Type: SCR power controllers with the following model designations and current ratings:

MP1 – 60-1200A

To which this declaration relates is in conformity with the technical requirements of the following documents:

Title:	Low-voltage switchgear and control gear	***No.*** IEC 947-5-1 ***Year:*** 1990-03
	Low Voltage Directive	***No.*** IEC 73/23/EEC ***Year:*** 1973-02
	Degrees of protection provided by enclosures (IP Code):	***No.*** IEC 529-2nd Edition ***Year:*** 1989-11
	Electromagnetic Compatibility	***No.*** IEC89/336/EEC ***Year:*** 1989-05

Warning
All phase-fired (PF) controllers will require line filters and possibly shielded cables to meet the EMC requirements.

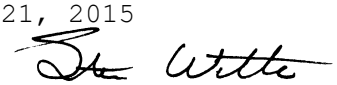
(Environmental protection classification IP00 - for mounting inside an enclosure)

Note: Characteristics are according to mfg specifications.

Name: Steve Wetta

Title: Director of Engineering

Date: July 21, 2015

Signature: 

Declaration written in accordance with I.S.O. - IEC/22 Guide

Note: Certification performed on December 12, 2008 and revision is address change only

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530 Lakeview Plaza Blvd. Ste C
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