

9. TROUBLESHOOTING

When determining a malfunction with a controller the following resources are available to diagnose the issue:

1. The Control Panel Software running on a PC or Android device connected using a USB-C cable.
2. On Digital and EtherCAT, parameters can be monitored or controlled over their respective fieldbus protocols.
3. Physical LED's on the controller. See the *Indicator LED* section for information on all LED conditions.

PWR (Power LED)	
OFF	No 24 VDC power
RED	Powered on, No AC Line Voltage
GREEN	Powered on, AC Line Lock OK
ORANGE	Phase Loss, or low or unstable AC Line Voltage

STAT (Status LED)	
OFF	None, not in any of the following states
RED	in FAULT State (Inhibit Alarm is active)
GREEN	in RUN State, Outputting
ORANGE	Active Warning Alarm <i>Controller will still output in this state</i>
Flashing RED	Initialization Error, in Wait for Enter State
Flashing ORANGE	Partial Load Fault Alarm is active

9.1. No Controller Output



CAUTION: Do not attach or remove wiring while AC power is applied.

ATOM power controllers will output when all the following conditions are met:

1. 24VDC is wired to command connector and capable of supplying at least 500mA of current to the controller.

Check that the power supply is wired correctly to pins 5 (-V) and 6 (+V) on the 6-pin connector. Ensure the power supply is on. The controller PWR (power) LED should be illuminated when 24VDC is present.

If the controller is connected via USB the power LED will be illuminated but will not output unless 24VDC is present.

2. AC Line is wired to the Line and Load connections and supplying between 24 - 600VAC to the controller.

The PWR LED will be green with AC line applied and phase lock has been achieved. If the PWR LED is red or orange, there is an issue with the AC Line voltage input.

3. The Controller is in RUN state

The Digital RUN Enable parameter [SP-25] is set to RUN (1).

Analog controllers do not use Digital RUN Enable and are always in RUN state unless there is a condition that places the controller in FAULT state.

4. A command setpoint is set greater than zero

The Digital Setpoint [SP-23] controls the setpoint command, additionally Digital/EtherCAT models provide a Fieldbus Setpoint [SP-24]. Analog controllers are equipped with an analog setpoint control wired to pins 3 and 4 of the 6-pin connector. If using the analog input, ensure the setpoint input type, low, high, and threshold settings are correct for the input signal type (voltage/current) and range.

A controller in SSR firing mode requires a setpoint of 100% to enable output.

5. The controller is not in Fault State

Any active inhibit alarm will put the controller in Fault state. Parameter [SP-212] will indicate any active inhibit alarm. The STAT LED will be red when an inhibit alarm has been triggered, output will be disabled and the Controller State parameter [SP-212] will be set to FAULT (2).

9.2. Alarms and Error Messages

The on-board LEDs on the ATOM Controller will indicate when a warning or inhibit alarm is active. The Control Panel software will show detailed information on what alarm(s) are active and allow additional diagnostics to determine the cause. Additionally Digital and EtherCAT models can access alarm states over their fieldbus protocol. See the *Alarms* section of this manual for descriptions and conditions for alarm triggers.

9.2.1. Warning Alarms

Status LED is orange during operation when a warning alarm is triggered.

The controller will continue to output with an active warning alarm.

The Warning Alarm Status parameter [MP-217] contains the binary mask of active warning alarms. The Control Panel will display all active warning alarms in the dashboard status bar.

Any of the following conditions will trigger a Warning Alarm:

Warning Alarm	Condition
Voltage/Current Limiting	The current or voltage supplied to the load is at the configured limit parameter values. Check actual current/voltage readings from the source and load vs parameter values.
Partial Load Fault	Detected load resistance has changed and exceeded the tolerance value defined in the PLF Tolerance parameter. An open or short may have occurred in one or more load elements.
Open Load	Infinite resistance Check wiring, check load for open circuit.
Shorted SCR	Controller has detected current flow while output is off. Check for short across Line/Load plugs.
High Temperature	Operating temp is high, check airflow around controller, check cooling fan operation (if equipped)

Warning alarms will automatically clear if the condition that triggered them falls within normal operating range.

Example Control Panel Dashboard showing an Open Load Warning Alarm



9.2.2. Inhibit Alarms

Status LED is illuminated red during operation with an active inhibit alarm.

Controller output will be disabled with an active inhibit alarm.

The Inhibit Alarm Status parameter [MP-204] contains the binary mask of active inhibit alarms. The Control Panel will display all active inhibit alarms in the dashboard status bar.

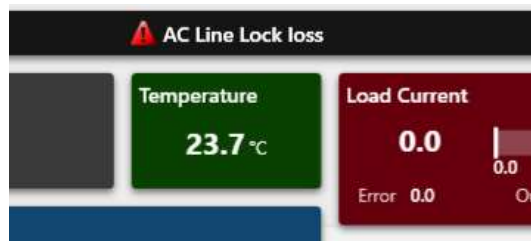
Any of the following conditions will trigger an Inhibit Alarm:

Inhibit Alarm	Condition
AC Line Lock Loss	Lost AC input phase lock, check AC line voltage and signal quality.
Overcurrent Trip ¹	Output current exceeded 240 amps, check for short in load circuit.
Over Temperature ¹	Controller temp exceeded safe operating range. (> 105 °C). Check airflow around controller, ensure mounting clearances are correct, check cooling fan operation. (if equipped)
Loss of Feedback ¹	Lost internal feedback signal to the processor. Reset the controller, if alarm re-occurs the controller has experienced a hardware failure.

¹ An overcurrent trip, over temperature, or loss of feedback alarm will place the controller in FAULT state.

Inhibit alarms that do not place the controller in FAULT state will automatically clear if the condition that triggered them falls within normal operating range. Controllers in FAULT state will not resume output until the FAULT state has been cleared.

Example Control Panel Dashboard showing an AC Line Loss Inhibit Alarm



9.2.3. Clearing Inhibit Alarms/Fault Reset

When an inhibit alarm is active, the controller will go into FAULT State and stop outputting. The controller will not go into RUN and resume output until the FAULT state is cleared.



Example Controller in Fault State with an 'Over Current Trip' inhibit alarm is active preventing controller output.

The STAT LED on the Controller will also be illuminated RED indicating the Controller is in Fault state.

Clearing FAULT State on Digital/EtherCAT models:

1. Set RUN Enable [SP-25] to STOP (0)
This will put the controller into FAULT RESET.
2. Set RUN Enable [SP-25] set back to the RUN (1)

Clearing FAULT State on Analog models:

1. Press the Reset switch (press for a minimum of 3 seconds), or power cycle the controller to clear FAULT state. Analog models are always in RUN state and try to return to RUN state after a FAULT on any controller restart.

FAULT Reset example (Digital/EtherCAT models only)

This controller was outputting and experienced an overcurrent trip and entered FAULT state.

Output has been disabled due to the overcurrent inhibit alarm. Although the switch position shows Run, the FAULT state overrides the Run/Stop control until the fault condition is corrected.

The Fault Reset is performed by setting the Stop/Run state to STOP (Using Control Panel this is equivalent to setting SP-25 to 0). This sets the controller in Fault Reset State.

The source of the current trip was then identified and corrected.

The controller can then be set back to RUN (SP-25 set to 1) to resume output. If the alarm that caused the FAULT state re-occurs, safely recheck all related components and connections to ensure normal operations can be resumed ¹.

¹ In the event of an over-temperature alarm, the controller must return to a safe operating temperature (< 105 °C) before this inhibit alarm will clear.



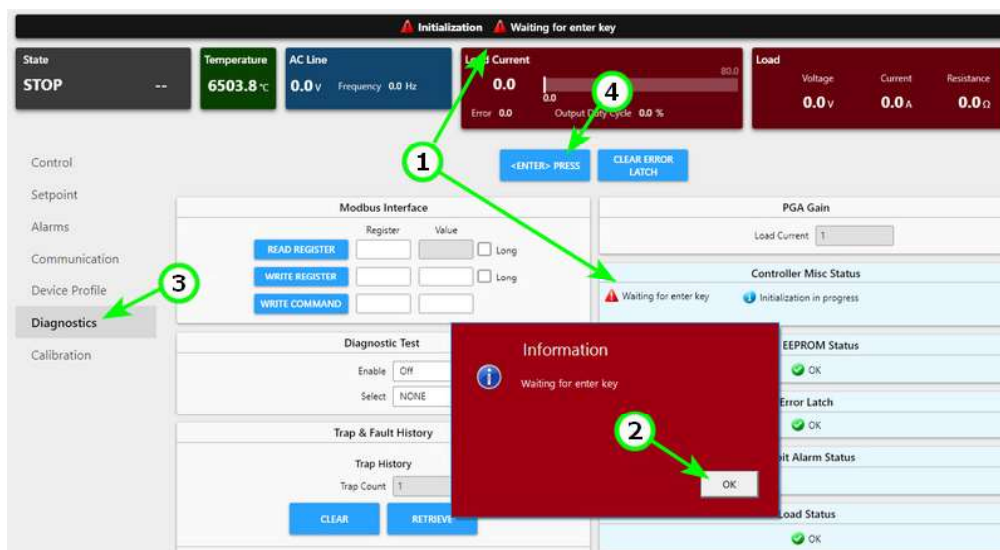
If this had been an Analog controller the FAULT state can be reset using the hardware reset button, use the Control Panel software, or power cycle the controller by removing and re-applying 24VDC power. Any of the above actions will clear the FAULT state and the controller will return to RUN state.

9.3. Waiting for 'ENTER'

The Controller is not responding, STAT LED is Flashing RED.

If the controller encounters an unexpected condition or error during initialization the processor will halt and enter a 'Wait for Enter' state. The Control Panel software must be used to clear this state and will provide additional information on what caused this condition.

Controller in Wait for Enter State, stopped during initialization



Clearing a 'Wait for Enter' State:

1. Connect to the controller via USB with the Control Panel software.
The dashboard will display the active inhibit alarm and a wait for enter dialog.
2. Press the OK button in the dialog.
3. Select the Diagnostics TAB.
4. Click the '<ENTER> PRESS' button.

This will clear the Initialization stop and if there is no further error(s) the Controller will start normally.

To view the reason for the startup failure check the Trap History in Control Panel.

Check Trap History for initialization error:

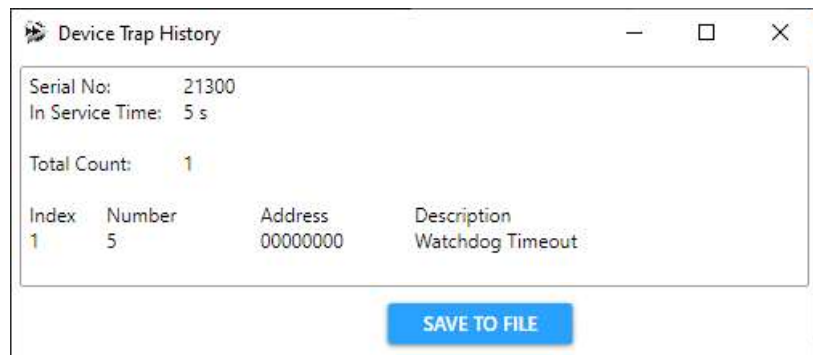
1. Select the Diagnostic tab in Control Panel.
2. Press the 'RETRIEVE' button in the Trap History panel.

A report will be displayed of current and past processor trap errors.



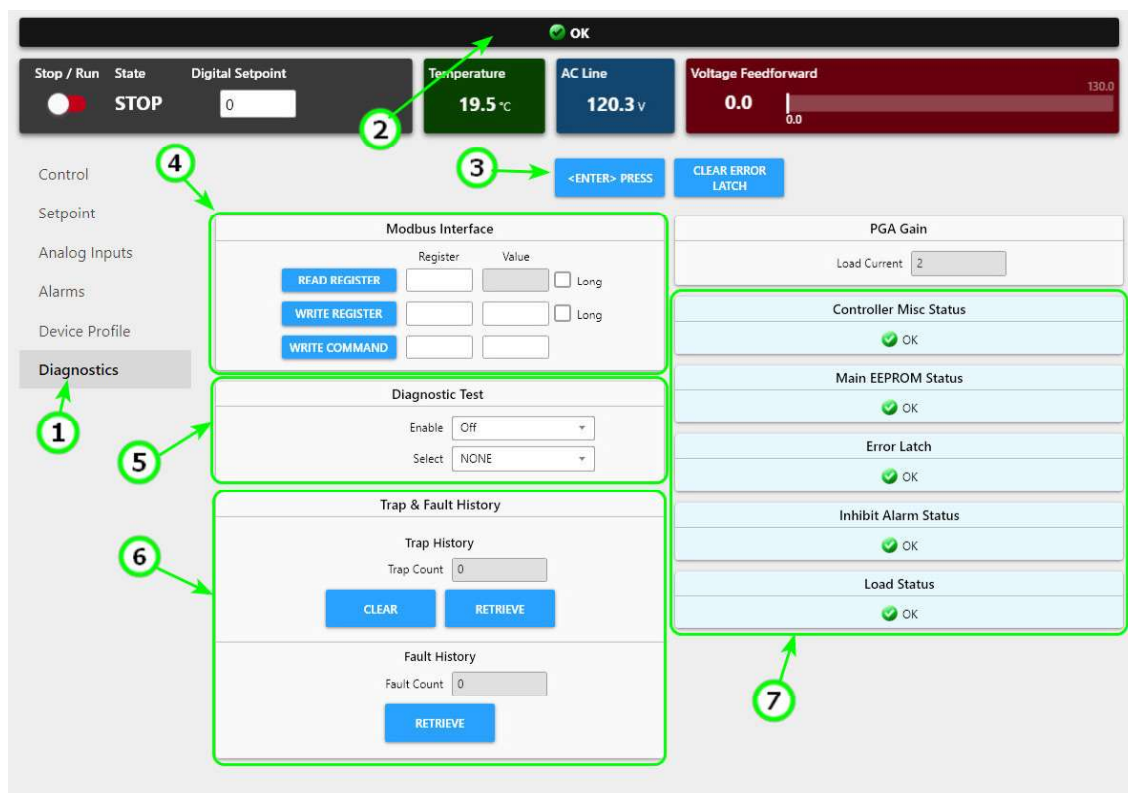
In the example on the right, a Watchdog Timeout has caused an initialization error. These history reports are useful to diagnose Controller errors when contacting technical support.

If an initialization error continuously re-occurs during controller start contact your distributor or the factory for further instruction on addressing the controller fault.



9.4. Diagnostics with Control Panel

The Control Panel Software Diagnostics tab provides real-time active states of the Controller.



The Diagnostic tab is broken up into several panels:

1. Diagnostic tab button; select this to display the diagnostic panels.
2. Dashboard status bar; displays active alarms and controller status.
3. ENTER button; clears 'Wait for Enter' error state to resume controller initialization.
CLEAR ERROR LATCH button; resets any error latch conditions displayed in the Error Latch status panel.
4. Modbus Interface; read and write Modbus register values, the Write Command is often reserved for factory tests.
5. Diagnostic Test; allows toggling states of the LEDs, Gates and Relay (if equipped).
6. Trap and Fault History; retrieve and clear error records.
7. Status panels; displays active processor, memory, alarms, and load states.

Consult the Control Panel User's Manual for additional information on using the Control Panel with the ATOM controller. The User's Manual is available as a PDF download on the Control Panel software web page.

The Control Concepts Control Panel software is available as a free download from our website at:

<https://ccipower.com/products/accessories/control-panel-software>

9.4.1. No USB Communication

If when connecting the ATOM controller via USB-C cable to a PC or Android device, Control Panel reports no communication or a time-out connecting to the controller:

1. Check the USB-C cable and connections.
2. Try a different USB-C cable.
3. Cable lengths greater than 15 feet (4.57 meters) may cause signal lose over long distances causing communication errors between Control Panel and the ATOM Controller.
4. Try a different USB port on the PC.

If none of the above steps resolves the communication issue, if available, try to connect to another ATOM controller to determine if the communication issue is particular to a single controller.

9.4.2. Trap and Fault History

Faults and Errors that might occur during controller operation are logged and can be viewed and exported to a file for reference. Any faults or trap errors are visible on the Diagnostic tab.

Trap and Fault History events are timestamped in the log as they occur. The event time is relative to the controller in-service time.

On Digital and EtherCAT models Fault History may include logged network timeout events which may be useful for network diagnostics in the event of communication errors.

Trap & Fault History	
Trap History Trap Count 0	
CLEAR	RETRIEVE
Fault History Fault Count 0	
RETRIEVE	

9.4.3. Diagnostic Status Panels

Displays live states of controller status. It is recommended to check this panel for any warnings or errors when troubleshooting issues with controller operation.

In the example below an Inhibit Alarm is active and in this case would disable the controller from operating.

Inhibit Alarm Status
 AC Line Lock loss

In addition, the Control Panel provides a 'Communication' tab that has a Network status panel that shows the current state of the fieldbus communication hardware.

When diagnosing network issues it is useful to check this panel for any network state information.

Ethernet Status	
 Ready	 IP Address Set
 Link 2 Connected	

Network status information is unique to each fieldbus type. See the Digital Fieldbus section of this manual for additional information on network status.

9.4.4. Error Latch

On the Diagnostic tab, one of the status panels is the Error Latch status.

The Error Latch will display events that negatively effect controller operation but may not be currently present while the controller is in operation. This is useful to catch intermittent issues or troubleshoot inconsistent errors or faults that cannot be reliably repeated.

In the example below an AC Line Phase Lock Loss event has occurred since the last time the Error Latch was reset.



Clearing the Error Latch

To clear the Error Latch events, press the 'CLEAR ERROR LATCH' button.
The Error Latch information is also cleared if the controller is reset or power cycled.



9.5. Fieldbus / Network Issues

Due to the complex protocols and differing network topologies no generalized troubleshooting guide will be applicable to all fieldbus issues. Refer to the *Digital Fieldbus* section of this manual for configuration settings for the fieldbus option that your controller shipped with.



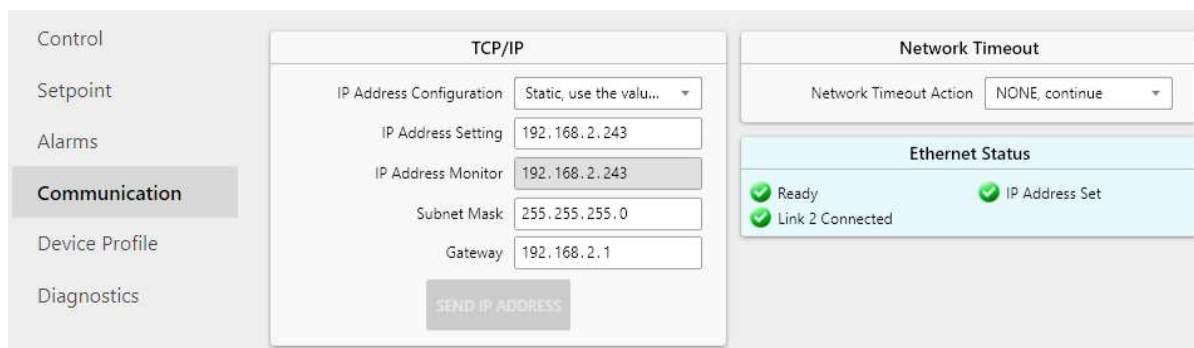
Control Concepts recommends using a minimum of CAT5e shielded cable between the controller(s) and other devices connected on the same network.

9.5.1. Network Hardware

1. Ensure all wiring and connections are properly seated.
2. All networking hardware power supplies should be grounded and wired according to local electrical codes.
3. External sources of spurious emissions should be evaluated and isolated from network cables and components.
4. Check the hardware configuration of any managed network devices to ensure proper connection routing.

9.5.2. Fieldbus Configuration Verification

The Control Panel software will display the configuration of the fieldbus and the current state of any network connections. The provided example shows an Ethernet/IP configured device. Available network options and status messages will vary with the fieldbus installed in the controller see the *Digital Fieldbus* section of this manual for details.



Example: Properly configured and connected Ethernet/IP Controller

9.5.3. ModbusTCP & Ethernet/IP Issues

If no network connection can be established, first check the green LED on the Ethernet RJ-45 jack.

Green RJ-45 LED state (Link Status)	
OFF	No network connection detected (Check cables and connections)
ON	Physical connection is good, no data is transferring
Flashing	Connected and data is transferring

Ethernet Status messages:

Not Initialized

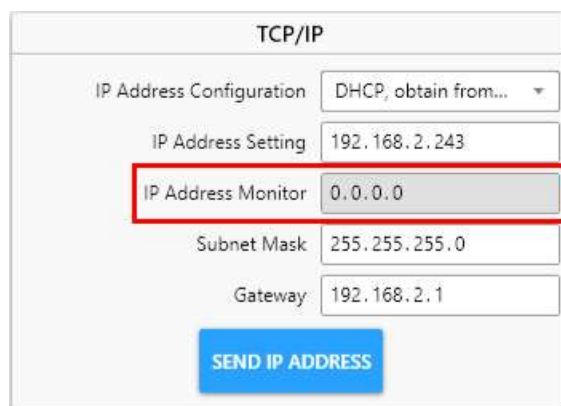
There is no hardware/wired connection detected.

1. Check cables and connections at the controller.
2. Check wiring to all endpoints on the network to the controller.

IP Address Not Set

The controller IP address has not been assigned or is invalid.

1. Check the IP Address Monitor in the Control Panel TCP/IP configuration panel. In the example to the right, the IP address monitor reads 0.0.0.0 with the controller set for DHCP. Therefore the controller cannot communicate with the DHCP server on the network.
2. If using a Static IP address, ensure the IP Address Setting, and Subnet Mask are correct for the LAN segment the controller should be operating on.
If incorrect, enter the proper addresses and press the 'SEND IP ADDRESS' button to update the controller.



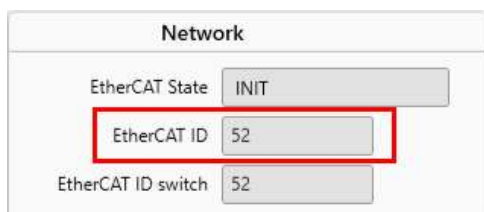
9.5.4. Profinet Issues

Profinet relies on external device discovery to assign its IP address. While the Control Panel allows for configuration of a static IP address the controller should be configured via the TIA portal, PRONETA, or other PLC software.

If using a third-party device ensure you have the GSD file provided by Control Concepts and have correctly imported the file into your PLC software.

9.5.5. EtherCAT Issues

1. Check the EtherCAT discrete Error (ERR) LED for an indication of a network issue.
2. If there is no indication of an error state but the controller is not recognized by the EtherCAT master device, check the station alias set in the ATOM controller.



ERR (Error/EtherCAT State)	
OFF	No Error
Blinking	Invalid Configuration
Single Flash	Unsolicited State Change
Double Flash	Application Watchdog Timeout
Flickering	Booting Error
ON	PDI Watchdog Timeout

Refer to the EtherCAT Technology group document: ETG.1300 EtherCAT Indicator and Labeling Specification for additional error information.

APPENDIX: 1-PHASE SPECIFICATIONS

POWER	
Line Voltage	24 - 600V Vac +10% / -15%
Line Frequency	45 - 65 Hz
Frame Current Ratings	16 32 50 65 Continuous RMS (AC)
Current Rating Peak Surge	15x continuous rating
Minimum Hold/Latch Current	500 mA RMS
SCR Rating (PIV)	1600 V peak forward and reverse
SCR Protection	DV/DT Protection 1000 V MOV
Device Load Protection	External load protection required
Fusing	Optional external Class T, branch-rated, touch-safe fusing
Device Protection	PCB mount integrated thermistor monitoring bus bar temperature
Power Dissipation	1.3 W per amp of load current
Controller Power Supply	24 Vdc

DC POWER CONSUMPTION		
Model	Frame Size	Power (watts)
Analog	< 50 A	2 W
	> 50 A	4 W
Digital and EtherCAT	< 50 A	3 W
	> 50 A	6 W

CONTROL FUNCTIONS	
Control Modes (set via USB or Fieldbus)	Description
Zero-cross	Standard algorithm
Fast Zero-cross	1 cycle on 1 cycle off
Phase Angle	Variable firing angle of line voltage cycle
Half-cycle DC	Variable phase angle firing for 1/2 cycle
On/Off Relay mode Zero-cross	Replacement for Zero-cross relay
On/Off Relay mode Phase Angle	Replacement for Random Relay
Load Configurations	Single Phase

CONTROL LOOP	
Feedback Types	Feed Forward Voltage RMS Current Proportional (Open Loop) On/Off (Relay mode)
Line Compensation	Yes (not in Proportional or Relay mode)
Set Point Sources	Description
Analog version	Analog Voltage Input - Selectable voltage range 0-10V 200k Ohm impedance - Max 32 VDC input for relay mode Analog Current Input - Selectable current range 0-20mA 249 Ohm impedance USB
Digital version	USB Certified EtherNet/IP with Add-on Profile (AOP) Certified Profinet Modbus TCP EtherCAT

PERFORMANCE	
Setpoint Resolution	10k
Internal Control Loop Resolution	32k
Output Resolution	30k @ 50 Hz, 25k @ 60 Hz
Response Time	Adjustable from 50 ms to 1 s
Accuracy (Full Conduction)	
Voltage	5.0% of line voltage
Current	5.0% of frame rating
Output Linearity	4.0% from (5 - 100%) output range
Accuracy	(+10% / -15%) line voltage change will result in a max output change of 2% (5 - 100% output range.)
Temperature Drift	Output shall not change greater than 1% per degree °C max over the operating temperature range from (5 - 100%) output range.

CONTROL FEATURES

Reset/Teach	Dual purpose button - Hold for processor reset - Momentary press to learn load resistance <i>(Not available on EtherCAT models)</i>
Soft Start	Slew rate USB settable, factory default ~ 200ms
TRANS-GUARD	Yes <i>(Not available in Fast Zero-cross mode)</i>
Missing Cycle Detection	Ramps from zero to setpoint when a missing power cycle is detected.
SYNC-GUARD	Yes, up to 8 units with sufficient bandwidth <i>(Only available on Digital models)</i>
Over Current Trip	Fixed at 240 amps
Current/Voltage Limit <i>(Buy up)</i>	IL adjustable from 20-105% of frame rating If not purchased, IL default = 105% of frame rating.
Shorted SCR <i>(Buy up)</i>	Detects if SCR is shorted
Partial Load Fault/ Open Load <i>(Buy up)</i>	Parameter settings - Tolerance in 5% increments Teach/Learn initiation - USB or ModbusTCP fieldbus - Momentary button on Analog and Digital

ALARM RELAY

Solid State, Form A	60 Vdc 100 mA / 42 Vac 100 mA RMS Relay mask via USB or Fieldbus setting
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RELIABILITY

Mean Time Between Failure (MTBF)	~ 50,000 Hours
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ISOLATION

Signal to Line/Load	3750 Vac minimum
Line/Load to Ground	2500 Vac minimum
Line to Load	1000 Vac minimum limited by MOV
Network	500 Vac minimum

ENCLOSURE PROTECTIVE RATING

International	IP 20
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ENVIRONMENTAL

Surrounding Air Operating Temp	Integrated heatsink: 0 to 50 °C
Humidity	20% to 90% RH Non-Condensing
Rated Operating Altitude	Up to 1750m (6000ft) at rated current.
Contaminates	ROHS Compliant CE Pollution Degree 2
Storage Temperature	-20 to 80 °C

MECHANICAL

Mounting	DIN Rail or Panel Mount
Cooling	Natural convection: 16, 32, 50 amp frames Forced air cooling: 65 amp frames
Insulation Protection Rating	CE & UL Protective Class I
EN 50178 Installation Category	Installation CAT II
IEC	IEC 60950-VDE0805 IEC60335-1-VDE0700-1 IEC62314
SCCR	100KA

1-PHASE SCCR - TYPE 1 COORDINATION

Frame Rating	Recommended Fusing *	SCCR Rating **
16	20A Fast Acting J or T	100 kA
32	40A Fast Acting J or T	100 kA
50	60A Fast Acting J or T	100 kA
65	80A Fast Acting J or T	100 kA

* Maximum fuse amps shown, fuses with lower amp ratings can also be used.

** To meet SCCR rating, fast acting J or T type fuses must be used.