PROCUREMENT SPECIFICATION

Bulletin 193/592 E300 Solid-State Overload Relays

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PART 1 GENERAL

1.01 QUALIFICATIONS

A. Manufacturer

1. The manufacturer shall have a minimum of 25 years of experience in the manufacture of solid-state overload relays.
2. The approved manufacturers are:

    a) Rockwell Automation Allen-Bradley
    b) Substitutions: None permitted

B. Support

1. The manufacturer shall maintain factory trained and authorized service facilities within 100 miles of the project and shall have a demonstrated record of service for at least the previous ten years.
2. Support personnel are to be direct employees of the manufacturer and be available 24 hours per day through a toll-free number.
3. The manufacturer shall provide all required start-up and training services.
4. The approved manufacturers are:

    a) Rockwell Automation Customer Support & Maintenance
    b) Substitutions: None permitted

C. Certification

1. To ensure all quality and corrective action procedures are documented and implemented, all manufacturing locations shall be certified to the ISO-9001 Series of Quality Standards.
2. Third-party manufacturers and brand labeling shall not be allowed.

1.02 REFERENCES

A. The motor protection relay shall be designed to meet or exceed the applicable requirements of the following agencies:

1. EN 60947-4-1
2. EN 60947-5-1
3. EN 60947-8-1
4. UL508
5. CSA C22.2 No. 14 (cUL)

B. The following standards shall be met:

1. Creep distances and clearances 600V (UL/CSA) and 500V (IEC)
2. Power terminal markings per EN 50005 and EN 60947
3. Dielectric withstand per UL 508 and IEC 947
4. Noise and radio frequency (RF) immunity per NEMA ICSA1-109
5. Surge withstand per IEEEC587 and IEC801-5

1.03 ENVIRONMENTAL REQUIREMENTS

A. The supplier shall confirm specified service conditions during and after installation of products.
B. The supplier shall maintain the area free of dirt and dust during and after installation of products.

1.04 PRE-MANUFACTURE SUBMITTALS

A. Refer to Section _____ for submittal procedures.
B. Product Data

1. Publications on solid-state motor protection relay.
2. Data sheets on all furnished options.

C. Specification Response

1. Detailed response to this specification showing where in the literature each requirement is satisfied.
2. Clearly identified clarifications and exceptions.

D. Installation Instructions

1. A copy of the manufacturer's installation instructions, including receiving, handling and storage instructions.

E. Testing and Test Reports

1. Testing per manufacturer's standard.
2. A copy of the test reports, if available, shall be provided as part of the final documentation.

1.05 FINAL SUBMITTALS

A. Refer to Section _____ for procedure on submittal of final documentation.
B. Supplier Certification

1. The supplier shall provide certification that the solid-state overload relay has been installed in accordance with the manufacturer's instructions.
2. The supplier shall provide certification that the solid-state overload relay settings have been properly adjusted.

C. Final Drawings

1. The manufacturer shall provide final drawings reflecting the "As-Shipped" state of the installed equipment.
2. Manufacturer drawings shall be provided in DWG format.
3. Manufacturer drawings do not need to be stamped if a drawing schedule is provided that lists the drawing numbers, revision levels, and status of drawings (Preliminary, Approval, Final, etc.)
4. The supplier shall be responsible for making any changes to the "As-Shipped" drawings from the manufacturer to reflect any field modifications.

D. Maintenance Data

1. Motor protection overload relay installation instructions and User Manual.
2. Parameter listing.
3. Field service report from start-up service.
4. Name and phone number for a local distributor for the spare parts.

PART 2 PRODUCTS

2.01 RATINGS

A. The motor protection relay shall have a current operating range of 0.5 to 65000 A.
B. All relay output contacts shall be rated B300.
C. The motor protection relay shall be capable of accepting the following nominal voltage for control power and activating digital inputs:

1. 24 VDC
2. 120 VAC 50/60 Hz
3. 240 VAC 50/60 Hz

D. The motor protection relay shall have a power supply operating range of 19 to 26 VDC, 85 to 132 VAC 50/60 Hz, or 184 to 265 VAC 50/60 Hz.
E. Environmental Specifications – The motor protection relay shall be:

1. Capable of operating in an environment with a relative humidity range of 0 to 95%, non-condensing.
2. Able to withstand a shock of 30 G (per IEC 68-2-27).
3. Able to operate without disruption for vibration levels up to 3 G (per IEC 68-2-6).
4. Able to operate without de-rating to an elevation of 2000 m.
5. Rated for an operating environment of -20 to +55°C (-4 to +131°F).
6. Rated for application in Pollution Degree 3 environments.

2.02 CONSTRUCTION

A. The motor protection relay shall be modular in construction consisting of up to six types of modules that connect together to make a functional system which include:

1. Sensing Module
2. Control Module
3. Communication Module
4. Operator Station – Control Station or Diagnostic Display (Optional)
5. Expansion I/O Modules (Optional)
6. Expansion Power Supply (Optional)

2.03 SENSING MODULES

A. Motor protection relay sensing modules shall be available for measuring 0.5 to 200 A of current without the use of current transformers. The sensing module shall provide three options of signal measurement:

1. Current
2. Current and Ground Fault Current
3. Voltage, Current, and Ground Fault Current

B. The motor protection relay shall have available an option to sense voltage internally for nominal low voltage applications up to 600 VAC 50/60 Hz per UL standards or 690 VAC 50/60 Hz per IEC standards without the need of external wires or fuses.
C. The motor protection relay shall offer the following metering functions:

1. Individual phase currents in amperes (2% accuracy)
2. Average current in amperes (2% accuracy)
3. Average motor load as a percentage of the motor full load ampere rating (2% accuracy)
4. Percent current imbalance or asymmetry (2% accuracy)
5. Zero sequence (core balance) ground fault current in amperes (2% accuracy)
6. Phase-to-phase voltage measurements (2% accuracy)
7. Three-phase average phase-to-phase voltage measurements (2% accuracy)
8. Phase-to-neutral voltage measurements (2% accuracy)
9. Three-phase average phase-to-neutral voltage measurements (2% accuracy)
10. Percent voltage imbalance (2% accuracy)
11. Real three-phase power expressed in kW (5% accuracy)
12. Reactive three-phase power expressed in kVAR (5% accuracy)
13. Apparent three-phase power expressed in kVA (5% accuracy)
14. Power factor (5% accuracy)
15. Real energy expressed in kWh (5% accuracy)
16. Reactive energy consumed expressed in kVARh (5% accuracy)
17. Reactive energy generated expressed in kVARh (5% accuracy)
18. Reactive energy net expressed in kVARh (5% accuracy)
19. Real demand expressed in kW (5% accuracy)
20. Reactive demand expressed in kVAR (5% accuracy)
21. Apparent demand expressed in kVA (5% accuracy)
22. Frequency (0.1 Hz of reading)

D. Electrical connections:

1. The motor protection relay shall work with three-phase or single-phase applications.
2. The motor protection relay shall be capable of direct connection and mounting to contactors in low voltage applications.
3. In medium and high voltage applications, the motor protection relay shall be wired in series with secondary windings from primary current transformers with a secondary current rating of 1 or 5 amperes.
4. The relay shall continue to provide a high level of motor protection in the event of saturation of primary current transformers when used.
5. Terminal connections and monitoring circuitry for connection of a zero sequence (core balance) current transformer for measuring ground fault current down to 20 mA shall be available. (Optional)
6. An internal zero sequence (core balance) current transformer for measuring ground fault current down to 500 mA shall be available. (Optional)
7. For medium and high voltage applications, the motor protection relay shall accept input from potential transformers in wye, delta or open delta configurations for secondary voltages up to 347 VAC 50/60 Hz per UL or 400 VAC 50/60 Hz per IEC.
8. For nominal low voltage applications, the motor protection relay shall be able to internally measure a voltage up to 600 VAC 50/60 Hz per UL standards or 690 VAC, 50/60 Hz per IEC standards. (Optional)
9. Wiring terminals shall provide IP20 finger protection.

2.04 CONTROL MODULES

A. The motor protection relay shall provide current measurement-based protection functions with optional voltage measurement-based and temperature measurement-based functions.
B. The motor protection relay shall incorporate the following protection function capabilities:

1. Current Elements

a) Thermal Overload (49/51)

i. FLA setting range of 0.5 to 65000 A
ii. Trip Class setting range of 5 to 30
iii. Reset mode adjustable for manual or automatic reset
iv. Reset level setting range of 1 to 100% TCU
v. Warning level setting range of 0 to 100% TCU

b) Current Imbalance / phase loss (46)
c) Ground Fault – zero sequence method (50N)
d) Undercurrent – load loss (37)
e) Overcurrent – load jam (48)

2. Voltage Elements

a) Undervoltage (27)
b) Overvoltage (59)
c) Phase Reversal (47) – voltage based
d) Over and Under Frequency (81) – voltage based
e) Voltage Imbalance (46)

3. Power Elements

a) Over and Under Power (37)
b) Over and Under Leading/Lagging Power Factor (55)
c) Over and Under Reactive Power Generated
d) Over and Under Reactive Power Consumed
e) Over and Under Apparent Power

C. Current (except Thermal Overload 49/51), voltage (except Phase Reversal 47) and power elements shall have individually adjustable:

1. Trip settings
2. Trip inhibit settings
3. Trip delay settings
4. Warning settings

D. The motor protection relay shall incorporate the following temperature elements:

1. PTC Thermistor (49) – Reset mode adjustable for manual or automatic reset.
2. RTD Sensors

a) The motor protection relay shall support up to 12 individually settable channels.

b) Each channel shall support the following 2 wire or 3 wire RTD sensor types

i. 100, 200, 500, 1000 ohm Platinum 385
ii. 100, 200, 500, 1000 ohm Platinum 3916
iii. 10 ohm Copper 426
iv. 120 ohm Nickel 618
v. 120 ohm Nickel 672
vi. 604 ohm Nickel-Iron

c) Each channel shall support the following data formats

i. Engineering Units X1 or X10
ii. Raw/Proportional
iii. Scaled for PID
iv. Percent Range

d) RTD sensors shall have trip and warning settings ranges of 0 - 65535.

E. The motor protection relay shall incorporate the following motor starting elements:

1. Start Inhibit – starts/hour (66)

a) Setting range of 0 - 120 starts/hour.
b) Setting range for minimum time between starts of 0 - 3600 seconds.

2. Emergency Start – The motor protection relay shall have provisions to perform an emergency override of a thermal trip through contact closure to an assigned input or via a command on the communications network.
3. Non-Reversing, Reversing, Two-Speed Starting and Custom Motor Control
4. Reduced Voltage Starting

F. The motor protection relay shall incorporate the following other element:

a) Remote Trip – The motor protection relay shall have provisions for tripping from an external device through contact closure to an assigned input or via a communications network command.

G. The motor protection relay shall incorporate the following control function capabilities:

1. The motor protection relay shall have provisions to reset a trip through contact closure to an assigned input.
2. The motor protection relay shall have provisions to reset a trip through a command via the communications network.
3. The isolated analog output signal shall be selectable for output of one of the following:

a) Average %FLA (Max = 100%)
b) Scaled Average %FLA (Max = 2 x FLA)
c) %TCU (Max = 100%)
d) Ground Fault Current (Max = 5A)
e) Current Imbalance (Max = 100%)
f) Average L-L Voltage (Max = 2 x PT Primary)

g) V L-L Imbalance (Max = 100%)
h) Total kW (Max = PT Primary x FLA x 1.732)
i) Total kVA (Max = PT Primary x FLA x 1.732)
j) Total kVAR (Max = PT Primary x FLA x 1.732)
k) Total PF (Min = -50%; Max = +50%)
l) User Defined

H. The motor protection relay shall incorporate the following diagnostic function capabilities:

1. The motor protection relay shall provide the following statistical values related to motor operation.

a) Percent thermal capacity utilized (%TCU)
b) Time to trip
c) Time to start
d) Time to reset
e) Elapsed time of operation
f) Operating time
g) Number of start cycles
h) Number of starts available

2. The motor protection relay shall store diagnostic data related to the 5 most recent trip and warning events. The data provided shall include:

a) Time and date of event
b) Trip and warning identification

3. The motor protection relay shall store diagnostic data related to the most recent trip event. The data provided shall include following at time of last trip:

a) Phase current magnitude values
b) Ground fault current magnitude values
c) Phase voltage magnitude values
d) Percent thermal capacity utilized
e) Total real power
f) Total reactive power
g) Total apparent power
h) Total power factor

I. The motor protection relay shall offer the following command function capabilities:

1. Restore Factory Defaults
2. Pre-configurations for motor control using digital inputs, the operator station and/or communications network:

a) Overload
b) Non-Reversing
c) Reversing
d) Wye/Delta
e) 2-Speed

3. Clearing Historical Information

    a) Clear Operation Statistics
    b) Clear Historical Logs
    c) Clear %TCU
    d) Clear kWh
    e) Clear kVARh
    f) Clear kVAh
    g) Clear Max kW Demand
    h) Clear Max kVAR Demand
    i) Clear Max kVA Demand
    j) Clear All

J. I/O connections:

1. The motor protection relay shall provide a minimum of two digital inputs that are configurable for function.
2. A minimum of two auxiliary relay outputs with Form A contacts shall be provided that are assignable in function including a Trip relay, Control relay, and Alarm relay.
3. The motor protection relay shall provide terminations and monitoring circuitry for connection of motor winding embedded positive temperature coefficient (PTC) thermistor sensors. (Optional)
4. Wiring terminals shall provide IP20 finger protection.
5. Wiring terminal connectors shall be pluggable.

K. The motor protection relay shall have an expansion bus that uses an RJ25 connector to add the additional digital modules, analog modules, supplemental power supply modules and operator stations. The expansion digital modules, analog modules, and supplemental power supply modules shall have two RJ25 connectors to be used for connecting to the expansion bus. The motor protection relay shall accept:

1. Up to 4 digital expansion modules and up to 4 universal analog expansion modules.
2. Either the starter control station or the diagnostic display station.

L. A Test/Reset button shall be provided on the front of the motor protection relay for the dual purpose of testing relay trip operation or resetting a trip.

M. Diagnostic LED indicators shall provide status indication that the motor protection relay is enabled and whether a trip or warning event is active.

2.05 COMMUNICATION MODULES

A. Network communications shall be accomplished through installation of a communication module.

B. The motor protection relay communication options shall have a mechanical interface to select the network node address.

C. Communication options shall include:

1. EtherNet/IP with Device Level Ring (DLR) support
2. DeviceNet

D. The EtherNet/IP communication option shall:

1. Have a web server that allows users to configure and read diagnostic information from the motor protection relay.
2. Have two RJ-45 Ethernet ports that act as a switch.
3. Support Beacon-based CIP Sync commands at a 400 usec beacon rate to work in conjunction with motion applications on the same network.
4. Support the IEEE 1588 End to End transparent clock.

2.06 OPERATOR STATION OPTIONS

A. The manufacturer shall have available as optional expansion:

1. A control station, or,
2. A diagnostic display station.

B. The expansion control station or diagnostic display station shall mount through a 22.5 mm push button cutout.
C. The expansion control station and diagnostic display station shall be rated for Type 4X (IP65) when installed in an appropriate enclosure.
D. The expansion control station shall enable upload and download of motor protection relay configuration parameters.
E. Diagnostic LED indicators shall provide status indication that the motor protection relay is enabled and whether a trip or warning event is active.
F. The expansion control station shall provide the following control commands:

1. Start 1 (Forward and Speed 1)
2. Start 2 (Reverse and Speed 2)
3. Local/Remote (enclosure control / communication network control)
4. Stop
5. Trip Reset

G. The default display mode shall automatically show the three individual instantaneous line currents with the option to change these to any of the available parameters.

2.07 EXPANSION I/O OPTIONS

A. An optional digital expansion module shall be available to provide:

1. 4 additional inputs.
2. 2 B300-rated relay outputs with Form A contacts.

B. An optional universal analog expansion module shall be available to provide:

1. 3 additional configurable analog inputs, including 0-20 mA, 4-20 mA, 0-5 VDC, 1-5 VDC, 0-10 VDC, resistance up to 6000 ohms, two-wire RTD sensors and three-wire RTD sensors.

a) Compatible with the commonly used sensor types.
b) Each channel individually settable for use with 100, 200, 500, 1000 ohm Platinum 385; 100, 200, 500, 1000 ohm Platinum 3916; 10 ohm Copper 426; 120 ohm Nickel 618; 120 ohm Nickel 672; or 604 ohm Nickel-Iron RTD sensors.

c) Individual RTD temperature measurements in °C or °F (2°C accuracy).

2. 1 configurable isolated analog output, including 0-20 mA, 4-20 mA and 0-10 VDC.

C. I/O connections:

1. Wiring terminals shall provide IP20 finger protection.
2. Wiring terminal connectors shall be pluggable.

2.08 SYSTEM DIMENSIONS

A. The dimensions of the motor protection relay for 30 A and 60 A applications shall not exceed 121.9 mm (4.80 in.) height x 44.8 mm (1.76 in.) width x 122.7 mm (4.83 in.) depth.
B. The dimensions of the digital and analog modules shall not exceed 98 mm (3.88 in.) height x 22.5 mm (0.9 in.) width x 120 mm (4.69 in.) depth.
C. The dimensions of the expansion supplemental power supplies shall not exceed 98 mm (3.88 in.) height x 44.8.5 mm (1.76 in.) width x 120 mm (4.69 in.) depth.
D. The dimensions of the expansion control station shall not exceed 44.8 mm (1.76 in.) height x 100 mm (3.94 in.) width x 33 mm (1.25 in.) depth.
E. The dimensions of the expansion diagnostic display station shall not exceed 70 mm (1.76 in.) height x 100 mm (3.94 in.) width x 33 mm (1.25 in.) depth.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. The supplier shall coordinate the shipping of equipment.
B. The supplier shall store the equipment in a clean and dry space.
C. The supplier shall protect the units from dirt, water, construction debris and traffic.

3.02 INSTALLATION

A. The supplier shall verify all solid-state overload relay settings have been properly adjusted prior to energizing.
B. The supplier shall ensure accessibility to diagnostic lights, communication ports and optional modules. These components shall be free from obstruction at all times.

3.03 SPARE MATERIALS

A. Provide one (1) spare overload relay of each size utilized, including options.

3.04 WARRANTY

A. The manufacturer shall provide their standard parts warranty for eighteen (18) months from the date of shipment or twelve (12) months from the date of being energized, whichever occurs first.
B. The manufacturer shall confirm this warranty as part of the submittal.

END OF SECTION

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