



## ENGINEERING SPECIFICATION

### SYMCOM MODEL 77C Single-Phase Electronic Overload Relay

#### PART 1 GENERAL

##### 1.1 REFERENCES

- A. UL 508 Industrial Control Equipment – Underwriters Laboratories
- B. IEC 60947 Low Voltage Switchgear and Controlgear – International Electrotechnical Commission
- C. CSA C22.2 No. 14 Industrial Control Equipment – Canadian Standards Association
- D. ANSI/IEEE C62.41 – American National Standards Institute/Institute of Electrical & Electronics Engineers
- E. MODBUS over Serial Line Specification and Implementation Guide V1.02
- F. UL 1053 Ground-Fault Sensing and Relaying Equipment – Underwriters Laboratories

##### 1.2 WARRANTY

- A. Manufacturer Warranty: The manufacturer shall guarantee the overload relay to be free from material and workmanship defects for a period of five years from the date of manufacture when installed and operated according to the manufacturer's requirements.

#### PART 2 PRODUCTS

##### 2.1 MANUFACTURERS

The equipment specified shall be the Model 77C, manufactured by SymCom, Inc.

##### 2.2 DESCRIPTION

- A. Regulatory Requirements:
  1. The equipment shall be UL Listed as type NKCR—Industrial Control Equipment-Motor Controllers-Auxiliary Devices.
  2. The equipment shall be ULC Listed as type NKCR7—Industrial Control Equipment-Motor Controllers-Auxiliary Devices Certified for Canada.
  3. The equipment shall be CE marked for use in the European Union and evaluated against IEC 60947 Low Voltage Switchgear and Controlgear.
  4. The equipment shall be CSA certified as class 3211-03—Industrial Control Equipment-Motor Controllers-Auxiliary Devices.

##### 2.3 PERFORMANCE/DESIGN CRITERIA: SINGLE-PHASE ELECTRONIC OVERLOAD RELAY

- A. Protective Relay Functions
  1. The equipment shall provide protection against the following conditions:
    - a. low voltage
    - b. high voltage
    - c. rapid cycling
    - d. undercurrent
    - e. overcurrent
- B. Communication Capabilities
  1. The equipment shall provide Modbus RTU communications capabilities when combined with the appropriate SymCom network communications modules. Visit [www.symcom.com](http://www.symcom.com) for the current list of communication modules.
  2. The equipment interface shall have the capability of connecting to the following systems:
    - a. MMI (Man Machine Interface)
    - b. SCADA (Supervisory Control and Data Acquisition) programs.
    - c. DCS (Distributed Control System)
    - d. PLC (Programmable Logic Controllers)
  3. The equipment shall support 9600 baud, Even parity, and 1 stop bit.
  4. The equipment shall provide setpoints that are readable and writable via the Modbus interface.
  5. The equipment shall provide the ability to energize and de-energize the relay via the Modbus interface.
  6. The equipment shall provide a 10-second Modbus network watchdog to trip the relay when Modbus communication is lost.
- C. Network Capabilities
  1. The equipment shall provide registers to read the following real-time values:
    - a. Line voltage
    - b. Current
    - c. Power factor
    - d. Restart Delay 1 (RD1) Time Remaining
    - e. Restart Delay 2 (RD2) Time Remaining
    - f. Restart Delay 3 (RD3) Time Remaining



- g. Trip status of the following:
    - 1) Network off command status
    - 2) Undercurrent
    - 3) Overcurrent
  - h. Last fault 1
  - i. Last fault 2
  - j. Last fault 3
  - k. Last fault 4
  - l. Unit ID
  - m. Model code
  - n. Motor run hours
2. The equipment shall provide the following readable/writable setpoints:
- a. Low voltage trip point
  - b. High voltage trip point
  - c. Current multiplier
  - d. Overcurrent trip point
  - e. Undercurrent trip point
  - f. Trip class setpoint
  - g. Restart delay 1 setpoint
  - h. Restart delay 2 setpoint
  - i. Restart delay 3 setpoint
  - j. Number of restarts after an undercurrent fault (#RU) setpoint
  - k. Number of restarts after a fault (#RO) setpoint
  - l. Undercurrent trip delay setpoint
  - m. Modbus address setpoint
  - n. Network status setpoint to enable the following features:
    - 1) Network watchdog
    - 2) Network program disable
    - 3) Front panel lock
  - o. Time units setpoint
  - p. Linear overcurrent trip delay
  - q. Command line to respond to the following commands:
    - 1) Network program enable
    - 2) Network program disable
    - 3) Clear run hours
    - 4) Clear last fault
    - 5) Enable network watchdog
    - 6) Disable network watchdog
    - 7) Start the motor
    - 8) Stop the motor

#### D. Capabilities and Features

- 1. Inputs
  - a. The equipment shall require a single-phase input voltage of 100-240VAC.
  - b. The equipment shall require a single-phase 50/60 Hz input voltage.
  - c. The equipment shall provide a connection to an optional external remote reset switch.
  - d. The equipment shall require no external CT's for motors with full load current ratings between 2 and 90 amps.
  - e. The equipment shall require external CT's for motors with full load current ratings greater than 90 amps.
  - f. The equipment shall accept full load current of 2-800 amps.
- 2. Outputs
  - a. The equipment shall include one Form C (SPDT) output relay. Contacts pilot duty rated 480VA@240VAC. Contacts general purpose rated 10A@240VAC.
- 3. Functional Specifications
  - a. The equipment shall include the following front panel setpoint ranges:
    - 1) an adjustable low voltage (LV) setpoint range of 85-262VAC
    - 2) an adjustable high voltage (HV) setpoint range of 86-264VAC
    - 3) an adjustable trip class (TC) setpoint range of 5, J5, 10, J10, 15, J15, 20, J20, 30, J30, Lln
    - 4) an adjustable rapid-cycle timer 1 (RD1) of 0, 2-500 seconds
    - 5) an adjustable motor cool-down timer (RD2) of 2-500 minutes
    - 6) an adjustable undercurrent restart delay timer (RD3) of 2-500 minutes
    - 7) an adjustable number of restarts after undercurrent (#RU) setpoint range of 0-4, A (automatic)
    - 8) an adjustable device communication address (ADDR) setpoint range of A01-A99
    - 9) an adjustable number of restarts after OC faults (#RO) setpoint range of 0-4, A (automatic)
    - 10) an adjustable undercurrent trip delay (UCTD) setpoint range of 2-60 seconds
    - 11) an adjustable linear overcurrent trip delay (OPT1) setpoint range 2-60 seconds
    - 12) an adjustable setting to define RD2 and RD3 in seconds or minutes (OPT2) of 1-3
    - 13) an adjustable multiplier (MULT) setpoint range of 1-10, 100, 150, 200, 300, 400, 500, 600, 700, 800
    - 14) an adjustable overcurrent (OC) setpoint range of (20-100A) ÷ MULT or 80-120% of CT Primary



- 15) an adjustable undercurrent (UC) setpoint range of (0, 10-98A) ÷ MULT or 40-100% of CT Primary
  - b. The equipment shall provide three independent adjustable restart delays:
    - 1) delay after power-up and rapid cycle
    - 2) delay after overcurrent faults
    - 3) delay after undercurrent faults
  - c. The equipment shall provide an undercurrent trip delay.
  - d. The equipment shall allow manual or automatic restart after a fault.
  - e. The equipment shall have the ability to display the last fault that caused the relay to trip off.
  - f. The equipment shall provide the ability to view runtime information.
  - g. The equipment shall provide a linear overcurrent trip delay.
  - h. The equipment shall provide a method to enable or disable undercurrent.
  - i. The equipment shall provide a front panel tamper guard, to prevent accidental setpoint changes.
  - j. The equipment shall provide the ability to clear the last fault using the front panel.
- E. Timing Requirements
- 1. The equipment shall provide an overload trip time that follows an inverse time trip curve.
  - 2. The equipment shall provide a linear overcurrent trip delay.
- F. Accuracy Requirements
- 1. The equipment shall provide a timing accuracy on all timers of 5% ±1 second.
  - 2. The equipment shall provide a current measurement accuracy of ±3% for currents <100 amps direct.
  - 3. The equipment shall provide a voltage measurement accuracy of ±1%.
- G. Human Interface Features
- 1. The equipment shall provide an adjustment dial to set the following setpoints:
    - a. Low Voltage (LV)
    - b. High Voltage (HV)
    - c. Multiplier (MULT)
    - d. Overcurrent (OC)
    - e. Undercurrent (UC)
    - f. Trip Class (TC)
    - g. Rapid-Cycle Timer (RD1)
    - h. Motor Cool-Down Timer (RD2)
    - i. Undercurrent Restart Delay Timer (RD3)
    - j. Number Of Restarts After Undercurrent (#RU)
    - k. Device Communication Address (ADDR)
    - l. Number Of Restarts After OC Fault (#RO)
    - m. Undercurrent Trip Delay (UCTD)
    - n. Linear Overcurrent Trip Delay (OPT1)
    - o. Minutes/Seconds Setting for RD2 and RD3 (OPT2)
  - 2. The equipment shall provide an adjustment dial to view runtime information.
  - 3. The equipment shall provide a 3-digit 7-segment display for viewing operating parameters of the device.
  - 4. The equipment shall provide a push button switch for the following functions:
    - a. Programming the device
    - b. Viewing the last fault
    - c. Resetting the device after a fault
    - d. Resetting the device during a restart delay
- H. Electromagnetic Compatibility
- 1. The equipment shall be immune to electrostatic discharge per IEC 61000-4-2, Level 3, 6kV contact discharge and 8kV air discharge.
  - 2. The equipment shall be immune to electrical fast transient bursts exceeding IEC 61000-4-4, Level 3. Specified limits shall be 3.5kV input power.
  - 3. The equipment shall be immune to electrical surges per IEC 61000-4-5, Level 3. Specified limits shall be 2kV line-to-line; Level 4, 4kV line-to-ground.
  - 4. The equipment shall be immune to surge and ring wave per ANSI/IEEE C62.41. Specified limits shall be 6kV line-to-line.
  - 5. The equipment shall be immune to radiated radio frequency emissions per IEC 61000-4-3, Level 3. Specified limits shall be 10V/m.
  - 6. The equipment shall be immune to conducted radio frequency emissions per IEC 61000-4-6, Level 3. Specified limits shall be 10V.



- I. Vibration/Shock Requirements
  - 1. The equipment shall withstand vibrations per IEC 68-2-6. Specified limits shall be 10-55Hz, 1mm peak-to-peak, 2 hours, 3 axis.
  - 2. The equipment shall withstand shocks per IEC 68-2-27. Specified limits shall be 30g, 3 axis, 11ms duration, half-sine pulse.
- J. Dielectric Isolation: Equipment withstands an alternating current potential of 1000V plus twice the rated voltage of the equipment for 1 minute without breakdown between uninsulated live parts and the enclosure with the contacts open and closed; between terminals of opposite polarity with the contacts closed; and between uninsulated live parts of different circuits.
- K. Enclosure Class of Protection: The equipment shall provide IEC IP20 (finger safe) protection.
- L. Short Circuit Requirements
  - 1. The equipment shall provide a short circuit rating of 100kA.
- M. Environmental Requirements
  - 1. The equipment shall operate continuously without de-rating in ambient temperatures of -20° to 70°C (-4° to 158°F).
  - 2. The equipment shall operate continuously without de-rating in relative humidity of up to 95% non-condensing per IEC 68-2-3.
  - 3. The equipment shall operate properly after storage in ambient temperatures of -40° to 80°C (-40° to 176°F).
- N. Dimensions: The equipment dimensions shall not exceed 3.0" in height X 3.6" in width X 5.1" in depth.
- O. Mounting:
  - 1. The equipment shall be mountable on standard 35 mm DIN rail.
  - 2. The equipment shall be surface mountable.
- P. Conformal coating:
  - 1. The equipment shall contain harsh environment conformal coating to help extend product life and to protect from hostile environments including moisture, temperature variations, salt spray, organic attack (fungus), and aggressive chemicals and vapors.

End of Section